Kimberly-Clark

FINAL REPORT
NO. 2 FUEL OIL AREA
KIMBERLY-CLARK
CHESTER, PENNSYLVANIA

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1.0 INTRODUCTION

Kimberly-Clark retained Atlantic Environmental Consulting Services, L.L.C. (Atlantic) to prepare this Final Report to document the soil and groundwater investigation and remediaton activities completed by Kimberly-Clark in the No. 2 Fuel Oil Area at its facility located at Front and Avenue of the States in Chester, Delaware County, Pennsylvania (hereafter the "Site" or "property"). A site location map is provided as Figure 1.

Kimberly-Clark completed the soil and groundwater investigation and remediation in the subject area in response to the release of No. 2 fuel oil in 1989. Throughout the 11-year period, the site activities were completed under the direction and in cooperation with the Pennsylvania Department of Environmental Protection (PADEP) and in accordance with the prevailing technical guidance. More recently, site activities reflect the concepts and evaluative methods described in the December 1997 final draft version of PADEP's Technical Guidance Manual for Act 2 (TGM).

The extensive investigation and remediation activities by Kimberly-Clark in order to remediate the No. 2 Fuel Oil Area and demonstrate attainment of PADEP soil and groundwater cleanup standards include the following:

- Operation of a groundwater remediation system between 1991 and 1995;
- Collection of influent and effluent samples from the treatment system to evaluate the effectiveness of the system;
- Removal for off-site recycling of approximately 10 cubic yards of soil containing residual petroleum;
- Collection of 22 soil samples within or immediately adjacent to the approximately 100 feet by 100 feet investigation area to demonstrate that concentrations of residual petroleum constituents in soil are less than the Non-Residential, Direct Contact and Soil to Groundwater Medium Specific Concentrations (MSCs);
- Collection of groundwater samples in direct contact with and immediately downgradient from the residual petroleum to demonstrate that the groundwater in the No. 2 Fuel Oil Area has been effectively remediated and that concentrations of residual petroleum constituents in groundwater are less than the Used Aquifer MSCs.

As previously discussed with PADEP, the purpose of this Final Report is to document that Kimberly-Clark has addressed the historic release of residual petroleum product in the No. 2 Fuel Oil Area in accordance with specific PADEP direction and technical guidance.

This report is divided into four chapters. Chapter 1 is the Introduction. In Chapter 2 the Physical Setting of the Site is presented. In Chapter 3, a discussion of the soil and groundwater investigation and remediation completed in the No. 2 Fuel Oil Area is presented. Final conclusions and recommendations regarding the No. 2 Fuel Oil Area are summarized in Chapter 4.

2.0 SITE BACKGROUND

2.1 Site Description and Surrounding Land Use

Kimberly-Clark operates a non-integrated paper mill at Front and Avenue of the States in Chester, Delaware County, Pennsylvania. The property is situated between the recently upgraded portion of State Highway Route 291 and the Delaware River, just east of Front Street. The facility manufactures sanitary paper products (consumer products) including, paper towels, toilet tissue, facial tissue and napkins. The property encompasses approximately 70 acres consisting of a number of buildings, which house plant offices, process areas, final product storage and distribution areas, and a co-generation plant (power plant). The vast majority of the site surface is covered with buildings, structures, and asphalt driveways or parking lots. The remaining portions are generally covered with gravel or trap rock.

As shown in Figure 2, the site is located in a heavily industrialized area designated as an Enterprise Zone by the City of Chester Planning Commission. A fence bounds the property to the west and the Delaware River runs to the east of the Site. Access to the Site is limited to employees and contractors, and the Site is secured by a guard service.

The No. 2 Fuel Oil Area is located within and surrounded by operating areas of the paper mill. As shown on Figure 3, the No. 2 Fuel Oil Area is situated between the terminus of Market Street and Chester Creek, near a former barge slip off of the Delaware River. The No. 2 Fuel Oil Area is limited in extent and measures approximately 100 feet wide by 100 feet long. Concrete dikes for aboveground storage tanks (ASTs), a paved roadway, and an approximately 2-foot thick layer of gravel and trap rock cover the surface of the No. 2 Fuel Oil Area. Overhead pipe racks traverse the area. The boiler house, the wastewater treatment area, and a storage building are located near the subject area.

2.2 Site History

Based on information available at the Delaware County Planning Commission and the Delaware County Historical Society, the portion of the Site occupied by the No. 2 Fuel Oil Area has been used for commercial or industrial purposes since the turn of the century. Records indicate that the Chester Shipping Company operated the No. 2 Fuel Oil Area from the early 1900's to approximately the 1940's. The 1950's series Sanborn Fire Insurance Maps indicate that Kimberly-Clark's predecessor, Scott Paper Company, began operating in the No. 2 Fuel Oil Area sometime after 1940. As such, the Site has been used for industrial purposes for over 100 years and will be used for non-residential purposes for the foreseeable future.

2.3 Geology

The Kimberly-Clark facility is located on the western edge of the Coastal Plain Physiographic Province of Pennsylvania. The Soil Survey for Chester and Delaware Counties, Pennsylvania indicates that the uppermost material underlying the asphalt and gravel surface covering in the No. 2 Fuel Oil Area is "made land". The "made land" fill material consists of silt, cinder, bricks, rocks, and wood used to build up the waterfront and provide structural stability for slab-grade buildings constructed on the previously low-lying areas. Fill material thickness ranges from eight feet to up to 16 feet (where the westernmost portion of the historic barge slip was filled). The fill material overlies an organic-rich swamp deposit or "meadow mat" which, in turn, overlies Quaternary age deposits of the Trenton Gravel. The Pennsylvania Geologic Survey describes the Trenton Gravel as "gray or pale-reddish brown, very gravelly unit interstratified with crossbedded and clay-silt beds".

At the Site, the Trenton Gravel overlies the Precambrian age Wissahickon Formation, which is typically characterized as a medium- to coarse-grained, banded, micacious schist. Borings advanced to 16 feet in the No. 2 Fuel Oil Area did not encounter bedrock. Two supply wells installed at the Site on the north side of Market Street in 1931 were advanced to 48 and 50 feet in depth, respectively, and were completed in the unconsolidated sediments. In the Penn Steel Area in the southern portion of the Site located to the south of Chester Creek, bedrock was encountered at approximately 63 feet in depth in a boring advanced near the waterfront.

2.4 Hydrogeology

Based on historical groundwater flow maps developed for other portions of the Site (Former UST Area and the Penn Steel Area), groundwater flows toward, and discharges to, the Delaware River. In the No. 2 Fuel Oil Area, the natural diffuse groundwater discharge is inhibited by the recently modified sheet pile bulkhead, which is driven an average of 32 feet into the underlying sediments. Depth to groundwater ranges from approximately 5 to 8 feet below ground surface (bgs) depending on the time of year and the tidal cycle on the adjacent Delaware River.

Based on telephone conversations with the Chester Water Authority, the site and surrounding area are serviced by public water. The Chester Water Authority obtains 100 percent of its water from surface water supplies located outside of the city. The main supply is withdrawn from the impoundment reservoir on Octorara Creek, along the Chester and Lancaster Counties border, located near Oxford, Pennsylvania. This supply is supplemented from a pumping station maintained on the Susquehanna River. Moreover, groundwater near the Site is not used for municipal, domestic, or agricultural use, nor is the Site known to fall within a Zone 2 Wellhead Protection Area. As such, groundwater at the Site appears to meet the criteria to qualify as a non-use aquifer as described in 25 Pa. Code 250.303.

2.5 Topography

The topography at the site slopes gently from the west, along Front Street, to the east, adjacent to the Delaware River. Elevations range from approximately 20 feet above mean sea level (amsl) to approximately 10 feet amsl along the bulkhead bounding the Delaware River waterfront (USGS, 1992).

2.6 Surface Water

The Site is located adjacent to the Delaware River, which constitutes the principal regional divide for both surface water and groundwater. The Delaware River flows to the south from the Site. Chester Creek flows across the Site from the west to the east. As shown in Figure 3, Chester Creek's confluence with the Delaware River is located just south of the No. 2 Fuel Oil Area. Stormwater runoff at the Site either percolates into the gravel trap rock covering portions of the Site or is directed into curbside gutters and storm drains for treatment at the facility's wastewater treatment system prior to discharge in accordance with a permit to the DELCORA wastewater treatment plant.

2.7 Climate

The climate associated with the Site is typical of that of the eastern United States. Most weather systems that influence the area originate from the west, and are steered by prevailing westerly winds, either eastward or northeastward parallel to the Atlantic coast.

Average daily winter temperatures for the region range from between 25 F and 42 F, with an average low of about 10 F. Average daily summer temperatures range between 82 F and 86 F with highs recorded in the nineties. Average monthly precipitation in the study area is fairly evenly distributed throughout the year, with maximum amounts occurring in the late summer months. The Chester, Pennsylvania area receives an average of 43.5 inches of rainfall per year.

2.8 Biological Features

Kimberly-Clark retained H&A Inc. of Newtown Square, Pennsylvania to complete an environmental assessment in support of the permit application for the bulkhead repair work adjacent to the No. 2 Fuel Oil Area. In it's report, H&A states the following:

- Near the Site, the Delaware River and Chester Creek are not stocked waters by the Pennsylvania Fish & Boat Commission;
- The recreational value of the Delaware River and adjacent land in the vicinity of Chester is minimal; and
- The Pennsylvania Natural Diversity Index (PNDI) search for portions of the Delaware River near the Site indicate no potential impacts to habitats for threatened or endangered plant or animal species associated with the Site.

In addition, the Natural Areas Inventory for Delaware County, Pennsylvania (1992) does not list sites of statewide significance for the protection of biological diversity or any sites of local significance based on size, diversity of wildlife and plant life, water quality protection, and recreational potential within or adjacent to the Site. The nearest listed site is Little Tinicum Island, which is located over two miles upstream from the Site. A preliminary ecological screening considering Section 250.311 of Act 2 for the No. 2 Fuel Oil Area indicates the following:

- There are essentially no exposed soil or vegetation in the No. 2 Fuel Oil Area. The area is covered by buildings, structures, asphalt-covered parking lots and roadways, and gravel and trap rock (potential exposure pathways appear to be obviously eliminated);

- The only potential compounds of concern in the No. 2 Fuel Oil Area are light petroleum fuels; and

- The No. 2 Fuel Oil Area is less than 2 acres in size.

Collectively, the above-referenced data indicate that biological features of concern are not present in the No. 2 Fuel Oil Area and that no further ecological screening is warranted.

3.0 SUMMARY OF INVESTIGATION AND REMEDIATION ACTIVITIES

Most of the activities described below have been previously documented with PADEP in historic correspondence and reports submitted as part of the ongoing interaction and cooperative efforts between PADEP and Kimberly-Clark regarding the No. 2 Fuel Oil Area investigation and remediation. The historic and recent Site activities are summarized below, in conjunction with related documentation provided in the enclosed appendices, to provide a stand-alone document to support PADEP approval of No Further Action in the No. 2 Fuel Oil Area.

3.1 Description of Release

In January 1989, No. 2 fuel oil was discovered leaking from a broken pipeline. The PADEP and the United States (U.S.) Coast Guard were notified of the release in accordance with the facility's Spill Prevention Countermeasures and Control (SPCC) Plan. The broken pipe was formerly used to supply fuel oil to the barge unloading station. The oil migrated form the pipe leak into a gravel french drain/dry well and through the adjacent storm sewer trench prior to discharging into the barge slip adjoining the Delaware River (see Figure 3). Upon discovering the release, Kimberly-Clark's predecessor (Scott Paper Company) took steps to stop the leak by immediately removing the fuel oil from the AST (Tank No. 4) supplying the broken pipe, closing the tank valves, cleaning the AST, inspecting the structural integrity of the AST. The facility retained Clean Harbors, Inc. of Deptford, New Jersey to use a vacuum truck to remove the remaining product inside the AST containment area and french drain/sump. In addition, Clean Harbors installed absorbent booms to capture and contain the oil in the barge slip before it reached the main channel of the Delaware River. The U.S. Coast Guard approved and periodically monitored the oil recovery efforts.

In January 1990, after a period of snow melt and heavy precipitation, facility personnel again observed a discharge of oil to the barge slip. Guardian Environmental Services of Bear, Delaware were immediately contacted to provide emergency response and follow-up services to contain and remove the floating oil. It was initially believed that the oil present in the subsurface was a result of the release that occurred during the previous leak in January 1989. However, during excavation activities near the Tank No. 4, facility personnel discovered a leak in a 3/8-inch diameter pipe connecting the No. 2 fuel oil pump house to the oil fill line from the barge unloading station. Although the barge pipeline used for barge unloading had not been used for some time prior to discovering the release, it was tested periodically. The small volume of product in the leaking 3/8-inch diameter line was used to pressurize the larger barge unloading line. The connection between the two lines became loose, and the small line was not valved off at the pump house when unused. Thus, whenever No. 2 fuel oil was pumped from the barge area to process areas in the paper mill, a small volume of oil was discharged to the subsurface area near the connection. Upon discovering this condition, the small line was immediately repaired and valved off at the pump house.

Documentation of the petroleum releases and the initial investigations in the No. 2 Fuel Oil Area was submitted to Ms. Kelly Kincaid of PADEP on July 16, 1990. A copy of the correspondence detailing the releases is provided in Appendix A.

3.2 Triegel & Associates, Inc. Investigation, October 1989

3.2.1 Soil Sample Results

In October 1989, Scott Paper Company contracted Triegel & Associates, Inc. (Triegel) of Berwyn, Pennsylvania to conduct a soil investigation and install a groundwater monitoring well in the No. 2 Fuel Oil Area. The results of the investigation were documented in the Triegel report *Subsurface Soils Investigation, No. 2 Fuel Oil Spill, Scott Paper Company* dated November 9, 1989 (Appendix B). The Triegel report was submitted to PADEP on July 16, 1990. As described in the Triegel report, the site investigation consisted of advancing six soil borings (TB-1 through TB-6) to depths ranging from 10 to 16 feet. The soil sample locations are shown on Figure 3.

Triegel attempted to collect continuous split-spoon soil samples from each boring. The soil samples were field screened with an organic vapor meter (OVM). Based on the results of field screening and field observations, one soil sample from each boring was submitted to Lancaster Laboratories (Lancaster), of Lancaster, Pennsylvania, for laboratory analysis of total petroleum hydrocarbons (TPH) by U.S. Environmental Protection Agency (EPA) Method 418.1.

As shown in Table 1, the soil sample depths ranged from 6 to 12 feet bgs. TPH concentrations in the six soil samples ranged from 180 to 8,900 milligrams per kilogram (mg/kg). However, many of the samples that Triegel submitted for laboratory analysis were collected from beneath the water table in a layer of high natural organic content ("meadow mat"). The historic TPH results reported by Method 418.1 may reflect, in part, naturally occurring organic material and not impacts from the petroleum release in the No. 2 Fuel Oil Area. Regardless, in accordance with the initial Act 2 guidance, TPH concentrations are to be used as a screening mechanism to evaluate the need for further parameter-specific testing; not as a specific cleanup criteria.

3.2.2 Soil Lithology

Based on maps available at the Delaware County Historical Society, the barge dock/slip previously extended into the area where the No. 2 fuel oil was released to the subsurface. Historic records indicate that the western portion of the barge dock and the Delaware River waterfront were backfilled to their present limits in the early 1900's. Lithologic logs of soil borings TB-3 and TB-6 confirm that fill material extends to a minimum depth of 16 feet in this area. Soil borings TB-1 and TB-2 were installed to the north of the barge dock and encountered approximately eight feet of fill material underlain by an organic-rich silt layer. Soil borings TB-4 and TB-5 encountered approximately eight feet of fill material underlain by wood and shell fragments (possible historic dredge material). A cross section of the No. 2 Fuel Oil Area based on the results of the Triegel boring logs is provided in Appendix B.

3.2.3 Groundwater Sample Results

In addition to advancing the six soil borings, Triegel installed a monitoring well immediately downgradient from the petroleum release location. Initially, Triegel deemed one monitoring well appropriate, because subsurface impacts were generally limited in areal extent to the vicinity of boring TB-6. The monitoring well was installed in the TB-6 borehole (see Figure 3).

Upon installation, Triegel measured the apparent product thickness in the monitoring well and collected a sample of the groundwater in direct contact with the floating petroleum product. The apparent product thickness measured approximately 3/8 inch. The groundwater sample was submitted for laboratory analysis of benzene, toluene, ethylbenzene, xylenes (BTEX), and petroleum fuels in groundwater. In addition, a sample of the separate-phase product was submitted for gas chromatographic fingerprinting.

As shown in Table 2, the benzene concentration in the groundwater sample was 20 micrograms per liter (ug/l). This concentration exceeds the current Used Aquifer (UA) Medium Specific Concentration (MSC) of 5 ug/l, but is less than the Non-Use Aquifer (NUA) MSC of 50 ug/l. Concentrations of the other parameters analyzed were less than their respective UA MSC's. As discussed in Sections 3.5 and 3.6, the concentrations of dissolved-phase petroleum constituents (including benzene) in groundwater in the No. 2 Fuel Oil Area have been remediated and/or attenuated in the 11 years subsequent to the release to concentrations below MSCs.

In the October 1989 report, Triegel noted that excavation of the area near the release was impractical due to overhead and underground piping and the potential for undermining the integrity of adjacent structures. As such, Triegel recommended the installation of a groundwater (total fluids) extraction and treatment system to remediate groundwater in the No. 2 Fuel Oil Area.

PADEP provided its comments to review of the Triegel report in a September 26, 1990 correspondence (Appendix C). In the response letter, PADEP concurred with the facility's proposed remediation plan.

3.3 Groundwater Remediation System Operation, March 1991 to November 1995

In the Fall of 1989, the facility contracted Triegel to design and install a groundwater remediation system to address the residual separate-phase product present in the subsurface of the No. 2 Fuel Oil Area. A summary of the treatment system operation history and treatment system monitoring results are provided in the report *Groundwater Remediation of Area Surrounding No. 2 Fuel Oil Loss* dated March 1, 1995. The report was submitted to PADEP in March 1995 and is provided for reference in Appendix D. An overview of the report is provided below.

In April 1990, two 24-inch diameter recovery wells were installed near the western bulkhead of the barge dock/slip, along the downgradient boundary of the No. 2 Fuel Oil Area. The locations of the recovery wells (Sump Nos. 1 and 2) are shown in Figure 3. The recovery wells were completed to a depth of approximately 12 feet bgs. The groundwater remediation system was designed to extract total fluids from the recovery wells. The water/product mixture was pumped to an oil/water separator, where product was skimmed for collection into a 500-gallon holding tank. The effluent from the oil/water separator was then transferred to a second oil/water separator within the facilities process wastewater stream. The treated water was then discharged into the plant wastewater treatment system which, in turn, discharges to DELCORA in accordance with permit limits.

Due to logistics with electrical service and connection to the plant wastewater system, the groundwater treatment was not operated until March 1991. After system shakedown and modifications in March 1991, the system was operated on an intermittent basis for the duration of 1991. Given that the water transfer lines from the treatment system to the plant wastewater system were not heat traced and could potentially freeze, the system operation was suspended in December 1991. Treatment system operations resumed in April 1992 and operated through December 1992. During 1991 and 1992, the treatment system influent and effluent were sampled to evaluate TPH concentrations.

Treatment system operations were resumed in June 1993. During 1993, the treatment system samples were analyzed for oil and grease concentrations. By October 1993, the oil and grease concentrations in the water being pumped from the two recovery wells and the absence of measurable separate-phase product indicated that the treatment system had effectively remediated groundwater to levels that rendered the oil/water separator unnecessary. Thus, subsequent to June 1993, the initial oil/water separator was removed from the treatment system and groundwater from the recovery wells was pumped directly into the plant wastewater stream. In December 1993, groundwater recovery operations were again suspended. In June 1994, the system operation commenced until December 1994. In December 1994, the treatment system effluent samples were analyzed for BTEX concentrations. BTEX were not detected in the groundwater collected from the recovery wells in December 1994.

By May 1995, PADEP had not responded to Kimberly-Clark's March 1995 report, so the treatment system was returned to continuous operation through November 1995. During that period, oil and grease concentrations ranged from 1.2 to 4.3 milligrams per liter (mg/L) indicating that separate phase product had been effectively removed from groundwater downgradient of the initial release. In correspondence dated April 2, 1996 (Appendix E), Kimberly-Clark requested PADEP approval to permanently discontinue system operations.

In an August 5, 1996 telephone conversation, between Ms. Karen Matio (formerly of Kimberly-Clark) and Mr. George R. Fritz of PADEP, PADEP requested collection of an additional round of groundwater samples from the recovery wells for analysis of the samples parameters specified in the August 1996 UST Closure Guidance Document. On August 18, 1996, Kimberly-Clark collected a groundwater sample for the analysis of BTEX, naphthalene, and methyl tertiary-butyl ether (MTBE). BTEX and naphthalene were not detected in the groundwater sample. The MTBE concentration of 2.2 ug/l is below the UA MSC. Based on the August 1996 groundwater sample results, Kimberly-Clark requested PADEP approval to discontinue operation of the groundwater treatment system. The request was submitted to PADEP in correspondence dated September 3, 1996 (Appendix E).

By June 1997, PADEP had not formally responded to Kimberly-Clark's September 1996 treatment system closure request. As such, a July 1997 site meeting between Kimberly-Clark and PADEP was requested to review the status of the No. 2 Fuel Oil Area and three other areas of investigation at the Site. At the July 1997 site meeting and during a follow-up teleconference on September 1, 1997, PADEP approved temporary suspension of the groundwater treatment system. However, PADEP qualified this approval by stating that PADEP review of additional soil sample data collected in accordance with the revised Act 2 guidance would be necessary in order for Kimberly-Clark to obtain a "No Further Action" approval from PADEP for the No. 2 Fuel Oil Area.

3.4 Smith Environmental Technologies Corporation Investigation, February 1995

In February 1995, the facility retained Smith Environmental Technologies Corporation (Smith) to conduct additional investigations in the No. 2 Fuel Oil Area to assess soil and groundwater conditions after completion of the groundwater remediation system operations. Smith installed two monitoring wells and collected soil samples for analysis of TPH, BTEX, and microbiological parameters to assess the potential for natural attenuation of the low concentrations of residual petroleum constituents remaining in soil. Subsequent to completion of the February 1995 investigation, Smith was reorganized. As such, results of the Smith investigation were not documented in a final report. A summary of the Smith investigation is provided below, and Smith documentation pertaining to the February 1995 investigation is provided in Appendix F.

3.4.1 Monitoring Well Installation

Smith contracted Advanced Drilling of New Holland, Pennsylvania to install two monitoring wells (MW-1 and MW-11) in the No. 2 Fuel Oil Area. Monitoring well MW-1 was installed to replace the previously existing monitoring well MW-1. The replacement monitoring well MW-1 was installed within the area of limited separate-phase product immediately downgradient from the release area. Monitoring well MW-11 was installed approximately 35 feet in the inferred hydraulic downgradient from MW-1, between MW-1 and the Delaware River. The well locations are shown on Figure 3. The MW-11 location was selected to confirm that the separate-phase product was limited to the immediate vicinity of MW-1 and that the groundwater quality downgradient from MW-1 was not impacted by the residual, weathered separate-phase product in MW-1.

The 4-inch diameter wells were completed to depths of 10.5 and 9.5 bgs, respectively. Each well was constructed with 5 feet of screen that bridged the water table. Lithologic and construction logs are provided in Appendix F.

3.4.2 Soil Sample Results

In addition to installing the monitoring wells, Smith collected six soil samples in February 1995. The soil samples were collected from the monitoring well MW-1 and MW-11 boreholes and from four additional borings installed by Advanced Drilling. The soil sample locations are shown on Figure 3. Soil samples were submitted to BCM Laboratories of Norristown, Pennsylvania for laboratory analysis of Diesel Range Organics (DRO) by modified USEPA Method 8015 and BTEX by USEPA Method 8020. As shown in Table 3, TPH concentrations in the six soil samples ranged from 306 mg/kg to 12,000 mg/kg. However, BTEX concentrations in the six soil samples were less than the limit of detection or, where quantifiable concentrations were detected, less than the current Act 2 Statewide Direct Contact and Soil-to-Groundwater MSCs. Laboratory results for the soil samples collected by Smith are also provided in Appendix F.

3.4.3 Microbiological Sample Results

In addition to submitting soil samples for laboratory analysis of chemical parameters, Smith submitted portions of the soil samples collected from the MW-1 and MW-11 boreholes for laboratory analysis of microbiological parameters. Samples collected for analysis of microbiological parameters were forwarded by BCM Laboratories to Terra Systems of Wilmington, Delaware. Terra Systems analyzed the soil samples for the following parameters;

- Heterotrophs, Hydrocarbon Utilizers, Total Kjeldahl Nitrogen (TKN), Ortho-Phosphate, Moisture Content, pH, and Iron.

Based on the results of the microbiological analysis, Terra Systems concluded the following:

- An active microbial population (heterotrophic and hydrocarbon-utilizing bacteria) is present;
- Nitrogen and phosphate are available;
- Environmental conditions are suitable for growth of microbes; and
- Therefore, conditions are favorable for biodegradation/attenuation of the residual hydrocarbons in soil in the No. 2 Fuel Oil Area.

The Terra Systems report is also provided in Appendix F.

3.5 Roux Associates, Inc. Investigations, 1997 and 1998

In response to PADEP's September 1997 request, Kimberly-Clark retained Roux Associates, Inc. (Roux) to complete additional investigations in the No. 2 Fuel Oil Area during 1997 and 1998. The objectives of the additional soil sampling were to delineate soil quality in the inferred downgradient direction from the highest historical petroleum constituent concentrations (i.e., SB-4) and to confirm that natural attenuation of residual petroleum constituents had occurred subsequent to collection of the soil samples by Smith in 1995. Roux completed additional activities to assess the extent of separate-phase product near monitoring well MW-1 and to further confirm that the water quality downgradient from monitoring well MW-1 was not impacted. Documentation pertaining to Roux investigation is provided in Appendix G. An overview of the Roux investigation is provided below.

3.5.1 Free Product Investigation

In March 1997, Roux monitored the former recovery wells and monitoring wells MW-1 and MW-11 for the presence of separate-phase product. A weathered, viscous separate-phase product was observed in monitoring well MW-1. There was no evidence of separate-phase product in MW-11 or either of the two former recovery wells. These observations are consistent with historical data which indicates that separate-phase product has not been present in the former recovery wells or observed discharging to the barge slip/dock since prior to discontinuing operation of the remediation system in November 1995.

In June 1997, monitoring well MW-11 was redeveloped to further evaluate the potential for migration of separate-phase product from the monitoring well MW-1 area. No separate-phase product was measured in monitoring well MW-11 prior to, during, or subsequent to pumping for redevelopment. These observations further confirm that the separate-phase product is limited to the immediate vicinity of monitoring well MW-1. In order to assess the potential rate of recovery and thickness of separate-phase product in monitoring well MW-1, a vacuum truck was used to evacuate the weathered, viscous product from monitoring well MW-1 once a week for four consecutive weeks in June and July 1997. The oil/water mixture was vacuumed and disposed by C.R. Warner of Philadelphia, Pennsylvania. The oil/water mixture slowly recovered to the well between each evacuation event. However, the exact thickness of the separate-phase product could not be measured due to its high viscosity and tendency to coat the oil/water interface probe.

In January 1998, a drum vacuum assembly was used to evacuate separate-phase product from monitoring well MW-1. The drum vacuum assembly tests were completed to evaluate the potential for separate-phase product recovery subsequent to completion of soil excavation/remediation (see Section 3.5.2) in the vicinity of monitoring well MW-1 and to define the thickness of residual separate-phase product in the immediate vicinity of monitoring well MW-1. Separate-phase product slowly recovered in monitoring well MW-1 between each evacuation event. However, the approximate apparent product thickness was only 0.01 feet.

3.5.2 Soil Remediation

On December 16, 1997, Roux oversaw completion of an exploratory test pit near monitoring well MW-1 to assess the potential for an ongoing source in this area and to excavate an apparently isolated pocket of separate-phase product from the immediate vicinity of MW-1. As shown on Figure 3, a trench deep was excavated adjacent to monitoring well MW-1. The trench was approximately 12 feet long by 3 feet wide and 5 feet. During excavation activities, petroleum-impacted soils were encountered at approximately three feet below ground surface. Approximately 10 cubic yards of petroleum-impacted soil were removed and they were recycled off-site at Clean Earth of New Castle, Delaware. Disposal documentation is provided in Appendix G.

Based on field observations and screening with an OVM, the north, south, and west sides of the excavation area showed no remaining indication of soil impact. The south side (inferred downgradient direction) of the excavation area is bounded by a concrete foundation. This foundation extended to the water table and may have served to effectively limit separate-phase product to the immediate vicinity of monitoring well MW-1. Due to structural limitations from overhead pipe rack supports and the concrete dike for the adjacent ASTs, soil between MW-1 and the No. 2 Fuel Oil AST dike could not be removed. After collection of the post-excavation soil sample (see Section 3.5.3), the area was backfilled with clean stone.

After removal of accessible impacted soil, a post-excavation soil sample (PE-1) was collected at the northwest end of the excavation area (near MW-1). The soil sample was submitted to American Environmental Network (AEN) of Whippany, New Jersey for analysis of polynuclear aromatic hydrocarbon (PAH) compounds in accordance with the prevailing Act 2 guidance at that time. As shown in Table 4, the results of the post-excavation sample analysis indicate that concentrations of the target parameters were less than the Act 2 Statewide MSCs. The laboratory results are provided in Appendix G.

3.5.3 Soil Sample Results

In January 1998, Roux retained Terra Probe of Jamison, Pennsylvania to advance three soil borings (SS-1 through SS-3) at the former location of SB-4 (completed by Smith) and in the inferred downgradient direction from the SB-4 location. The highest historical TPH concentrations were detected at the SB-4 location. The objective of the January 1998 investigation was to assess the potential for natural attenuation of the petroleum constituents at the SB-4 location during the approximately 3-year interim period subsequent to the Smith investigation and, therefore, confirm the Terra Systems contention that natural biodegradation of the residual petroleum constituents was occurring in the No. 2 Fuel Oil Area soils.

A Geopbrobe™ unit was used to collect the soil samples from the 6-inch interval above the water table in each boring. In accordance with the prevailing UST Closure Guidance Document, the samples were analyzed for the PADEP No. 2 fuel oil parameters (naphthalene, fluorene, benzo(a)anthracene, benzo(a)pyrene, and phenanthrene). As shown in Table 4, the results of the soil sample analyses indicate that concentrations of the target parameters were less than the Act 2 Statewide MSCs and, that the TPH concentrations in the SB-4 location had decreased from 12,000 mg/kg to 10 mg/kg. Furthermore, the laboratory results for the SS-2 and SS-3 soil samples, located downgradient from the SB-4, indicate that the residual petroleum constituents decrease downgradient from SB-4. Laboratory results are provided in Appendix G.

In December 1998, Roux collected six additional soil samples from six supplemental locations (B-1 through B-6) surrounding the localized pocket of residual separate-phase product in the vicinity of monitoring well MW-1. The objective of the December 1998 investigation was to fully delineate the extent of soil containing residual petroleum constituents as well as to supplement existing soil data, given that changes in the Act 2 TGM now require additional No. 2 fuel oil-related investigation parameters (effective April 1, 1998).

During the December 1998 sampling event, Roux used historical TPH soil sample results to guide and constrain the six supplemental sample locations in the No. 2 Fuel Oil Area. As shown in Table 5, results from the December 1998 investigation indicate that concentrations of the target parameters in five of the six soil sample locations were less than the Act 2 Statewide Direct Contact and Soil to Groundwater MSCs. Only one of the six soil samples had an exceedance of any target compound. Naphthalene slightly exceeded the UA Soil to Groundwater MSC in soil sample B-5. However, the concentration of naphthalene in soil sample B-5 is less than Direct Contact and the NUA MSCs. In addition, empirical data for the groundwater samples collected from the recovery wells (see Section 3.5.4) located immediately downgradient from the B-5 location demonstrate that the low levels of naphthalene in B-5 are not contributing to groundwater degradation. Moreover, the B-5 sample was collected from a depth of approximately 8.0 feet bgs, and the B-5 sample location is located beneath an asphalt driveway.

Laboratory results and soil boring logs for the December 1998 soil sample event are provided in Appendix G.

3.5.4 Groundwater Sample Results

In conjunction with the soil investigation activities completed in January 1998, Roux also collected four additional groundwater samples from monitoring points located in the inferred hydraulic downgradient direction from MW-1 (i.e., between MW-1 and the Delaware River). The monitoring points included MW-11, the two former recovery wells, and a temporary well point (GW-1). In accordance with the current PADEP No. 2 fuel oil parameters as of 1998, the groundwater samples were submitted to AEN for laboratory analysis of BTEX and naphthalene. As shown in Table 6, residual petroleum constituent concentrations were below the limit of detection in the four groundwater samples. These recent data are consistent with historical data, which indicate that the groundwater quality downgradient from the monitoring well MW-1

location was effectively remediated through intermittent operation of the groundwater remediation system between 1991 to 1995. Laboratory results for the January 1998 groundwater samples are also provided in Appendix G.

3.6 Atlantic Environmental Consulting Services Investigation

Act 2 guidance allows for the possibility of leaving separate-phase product on site by requiring that groundwater directly in contact with the separate-phase product is submitted for laboratory analysis of petroleum constituents. To further support Kimberly-Clark's request for No Further Action in the No. 2 Fuel Oil Area, Atlantic collected a sample of the groundwater in direct contact with the weathered, residual separate-phase product in monitoring well MW-1 in July 1999. The groundwater sample was submitted to Lancaster Laboratories for analysis of Act 2 Petroleum Shortlist parameters for fuel oils No. 2, 4, 5, and 6. As shown in Table 7, concentrations of the target parameters were less than the UA MSCs. These data demonstrate that the weathered, residual separate-phase product in monitoring well MW-1 is not adversely impacting groundwater quality in the No. 2 Fuel Oil Area.

In addition, a comparison of the 1999 data for the MW-1 groundwater sample (Table 6) with the 1989 groundwater sample data collected by Triegel (Table 2) clearly demonstrates that groundwater concentrations in contact with the separate-phase product have attenuated in the 10-year period. Between 1989 and 1999, benzene concentrations in groundwater in direct contact with the separate-phase product have decreased from 20 ug/l to 0.3 ug/l. Toluene and ethylbenzene concentrations decreased from 20 ug/l and 80 ug/l, respectively, to below the limit of detection.

4.0 FINDINGS AND CONCLUSIONS

Kimberly-Clark has conducted extensive soil and groundwater investigation and remediation in the subject area in response to the release of No. 2 fuel oil in 1989. The site investigation and remediation activities have been completed under the direction and in cooperation with the Pennsylvania Department of Environmental Protection (PADEP). Throughout the 11-year period, the site activities were completed in accordance with the prevailing technical guidance. More recently, site activities reflect the concepts and evaluative methods described in the December 1997 final draft version of PADEP's Technical Guidance Manual for Act 2 (TGM). Key highlights of the comprehensive activities completed by Kimberly-Clark in the No. 2 Fuel Oil Area include the following:

- The No. 2 Fuel Oil Area is situated within the interior of the Kimberly-Clark's Chester, Pennsylvania facility, which is located within a designated Enterprise Zone that has been used for industrial purposes for over 100 years. A chain link fence encloses the Kimberly-Clark facility, and access to the facility is continuously monitored by a guard service. As such, the only people with access to the No. 2 Fuel Oil Area are Kimberly-Clark personnel. The No. 2 Fuel Oil Area is covered entirely by asphalt and ballast. Accordingly, direct contact exposure pathways for facility workers to the low-level residual petroleum constituents in soil have been eliminated through institutional and engineering controls.

- Twenty-two soil samples have been collected within or immediately adjacent to the approximately 100 feet by 100 feet area comprising the No. 2 Fuel Oil Area. Sixteen of the samples have been collected subsequent to 1995 in accordance with the prevailing Act 2 guidance. In 15 of the 16 soil samples collected since 1995, concentrations of target parameters were either less than the limit of detection or less than Act 2 MSCs. In one sample (B-5), the naphthalene concentration (61 mg/kg) exceeded the UA Soil to Groundwater MSC of 5 mg/kg, but was two orders of magnitude less than the NUA Soil to Groundwater MSC of 5,000 mg/kg. Regardless the concentration of naphthalene in the B-5 sample, empirical groundwater sample data from the recovery wells located immediately downgradient from the B-5 sample location demonstrate that the low levels of naphthalene in B-5 are not adversely impacting groundwater quality in the No. 2 Fuel Oil Area.

- Discussions with the Chester Water Authority indicate that the agency obtains 100 percent of its water supply from outside of Delaware County and that there are no domestic or agricultural wells located near or within the Kimberly-Clark facility. Furthermore, the No. 2 Fuel Oil Area is not located within a Zone 2 wellhead protection area. Although a formal Non-Use Aquifer Determination has not been submitted to PADEP, the Site appears to meet the criteria to qualify as a non-use aquifer as described in 25 Pa. Code 250.303.

- The area is entirely covered by asphalt, ballast, or the slab grade foundations of site structures. The only constituents of concern are light petroleum constituents, and the subject area is less than 2 acres in size. Furthermore, studies completed by others in support of the bulkhead replacement permit indicate that there are no flora or fauna of biological concern in the No. 2 Fuel Oil Area. A preliminary ecological screening considering Section 250.311 of Act 2 for the No. 2 Fuel Oil Area indicates that no further ecological screening appears to be warranted.

- Kimberly-Clark operated a groundwater remediation system to address separate-phase product in the No. 2 Fuel Oil Area between 1991 and 1995. Separate-phase product has not been present in the former recovery wells, monitoring well MW-11 or observed discharging to the barge slip/dock since prior to discontinuing operation of the remediation system in November 1995. The only separate-phase product remaining in the No. 2 Fuel Oil Area is an isolated pocket in the immediate vicinity of monitoring well MW-1. Separate-product evacuation tests in, and investigations adjacent to monitoring well MW-1, indicate that the actual product thickness remaining is less than 0.1 inch. Furthermore, migration of the separate-phase product from the monitoring well MW-1 area is likely limited by its high viscosity and a subsurface foundation located within 10 feet immediately downgradient of MW-1.

- Approximately 10 yards of accessible petroleum-impacted soil in the vicinity of monitoring well MW-1 was removed for off-site disposal in December 1997. Further removal of the separate-phase product in the vicinity of monitoring well MW-1 is technically impractical due to structural limitations, the limited actual product thickness, and the high viscosity of the product.

- Samples of groundwater in direct contact with the separate-phase product were collected in 1989 and again in 1999. A comparison of the 1999 data with the 1989 groundwater sample data clearly demonstrates that groundwater in contact with the separate-phase product has attenuated in the 10-year period. Between 1989 and 1999, benzene concentrations in groundwater in direct contact with the separate-phase product decreased from 20 ug/l to 0.3 ug/l. Toluene and ethylbenzene concentrations decreased from 20 ug/l and 80 ug/l, respectively, to below the limit of detection. Furthermore, the 1999 data demonstrate that the weathered, residual separate-phase product in monitoring well MW-1 is not adversely impacting groundwater quality in the No. 2 Fuel Oil Area.

- In addition to evaluating the quality of groundwater in direct contact with the separate-phase product, Kimberly-Clark has assessed the downgradient groundwater quality between monitoring well MW-1 and the Delaware River. Groundwater samples collected from MW-11 and the recovery wells indicate that dissolved-phase petroleum constituent concentrations were below the limit of detection. Given that the concentrations of residual petroleum constituents in groundwater in direct contact with the separate-phase product are less than the Act 2 MSCs, it is totally consistent that concentrations in downgradient monitoring points are less than the limit of detection.

In summary, Kimberly-Clark operated a groundwater remediation system between 1991 and 1995, excavated approximately 10 cubic yards of petroleum-impacted soil for off-site disposal, completed soil and groundwater investigations which demonstrate attainment of PADEP soil and groundwater cleanup standards, and no soil, groundwater, or ecological exposure pathways exist in the No. 2 Fuel Oil Area . Accordingly, No Further Action is warranted of Kimberly-Clark in the No. 2 Fuel Oil Area.

Table 1. Soil Sample Results, October 1989; No. 2 Fuel Oil Area, Kimberly-Clark, Chester, Pennsylvania.

Parameter	TB-1	TB-2	TB-3	TB-4	TB-5	TB-6
Total Petroleum Hydrocarbons	**430**	**750**	180	570	8,900	3,900
Sample Depth[1]	**6-7**	**8-10**	8-10	10-12	8-10	8-10

Concentrations in milligrams per kilogram (mg/kg), on a dry weight basis.
Samples collected by Triegel & Associates, Inc.
[1] In feet below ground surface.

Table 2. Groundwater Samples Results for Monitoring Well MW-1, October 1989; No. 2 Fuel Oil Area. Kimberly-Clark, Chester, Pennsylvania.

Parameter[1]	MW-1
Benzene	20
Toluene	20
Ethylbenzene	80
Total Xylenes	370
Petroleum Fuel in Water	15

Concentrations in micrograms per liter (ug/l).
Samples collected by Triegel & Associates, Inc.

Table 3. Soil Sample Results, February 1995; No. 2 Fuel Oil Area, Kimberly-Clark, Chester, Pennsylvania.

Parameter	SB-1 (MW-1)	SB-2	SB-3	SB-4	SB-5 (MW-11)	SB-7	Field Blank	Trip Blank
Benzene	ND	ND	ND	ND	ND	ND	ND	ND
Toluene	ND	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	ND	1.59	ND	0.863	1.24	4.8	ND	ND
Total Xylenes	ND	1.78	0.136	1.07	1.63	5.14	ND	ND
Total Petroleum Hydrocarbons	1,240	551	306	12,000	5,160	2,460	ND	NA

Concentrations in milligrams per kilogram (mg/kg), on a dry weight basis.
Samples collected by Smith Environmental Technologies Corporation
ND=Not detected above the method detection limit.
NA=Not analyzed.

Table 4. Soil Sample Results, January 1998; No. 2 Fuel Oil Area, Kimberly-Clark, Chester, Pennsylvania.

Parameter	SS-1	SS-2	SS-3	PE-1	Field Blank
Benzo(a)anthracene	1.5	ND	0.97	0.63	ND
Benzo(a)pyrene	1.6	ND	1.1	0.58	ND
Naphthalene	0.081J	ND	ND	ND	ND
Fluorene	0.31	ND	0.068J	ND	ND
Phenanthrene	2.4	0.15	0.86	0.7	ND
Total Petroleum Hydrocarbons	10	17	18	13	NA

Concentrations in milligrams per kilogram (mg/kg), on a dry weight basis.
Samples collected by Roux Associates, Inc.
ND=Not detected above the method detection limit.
NA=Not analyzed.

Table 5. Soil Sample Results, December 1998; No. 2 Fuel Oil Area, Kimberly-Clark, Chester, Pennsylvania.

Parameter	B-1	B-2	B-3	B-4	B-5	B-6	Field Blank
Benzene	ND	ND	ND	ND	ND	ND	ND
Toluene	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	ND	ND	ND	0.082	ND	1.2	ND
Isopropylbenzene	ND	ND	0.21	0.14	ND	1.4	ND
Naphthalene	ND	0.15	ND	ND	**61**	2.8	ND
Fluorene	0.31	1.6	7.4	1.2	**94**	17	ND
Phenanthrene	1.5	4.3	23	1.0	**220**	35	ND

Concentrations in milligrams per kilogram (mg/kg), on a dry weight basis.
Samples collected by Roux Associates, Inc.
ND=Not detected above the method detection limit.
NA=Not analyzed.
Exceedances of the most stringent Medium-Specific Criteria are highlighted in bold font.

Table 6. Groundwater Sample Results for Downgradient Monitoring Points, January 1998, Oil Area, Kimberly-Clark, Chester, Pennsylvania.

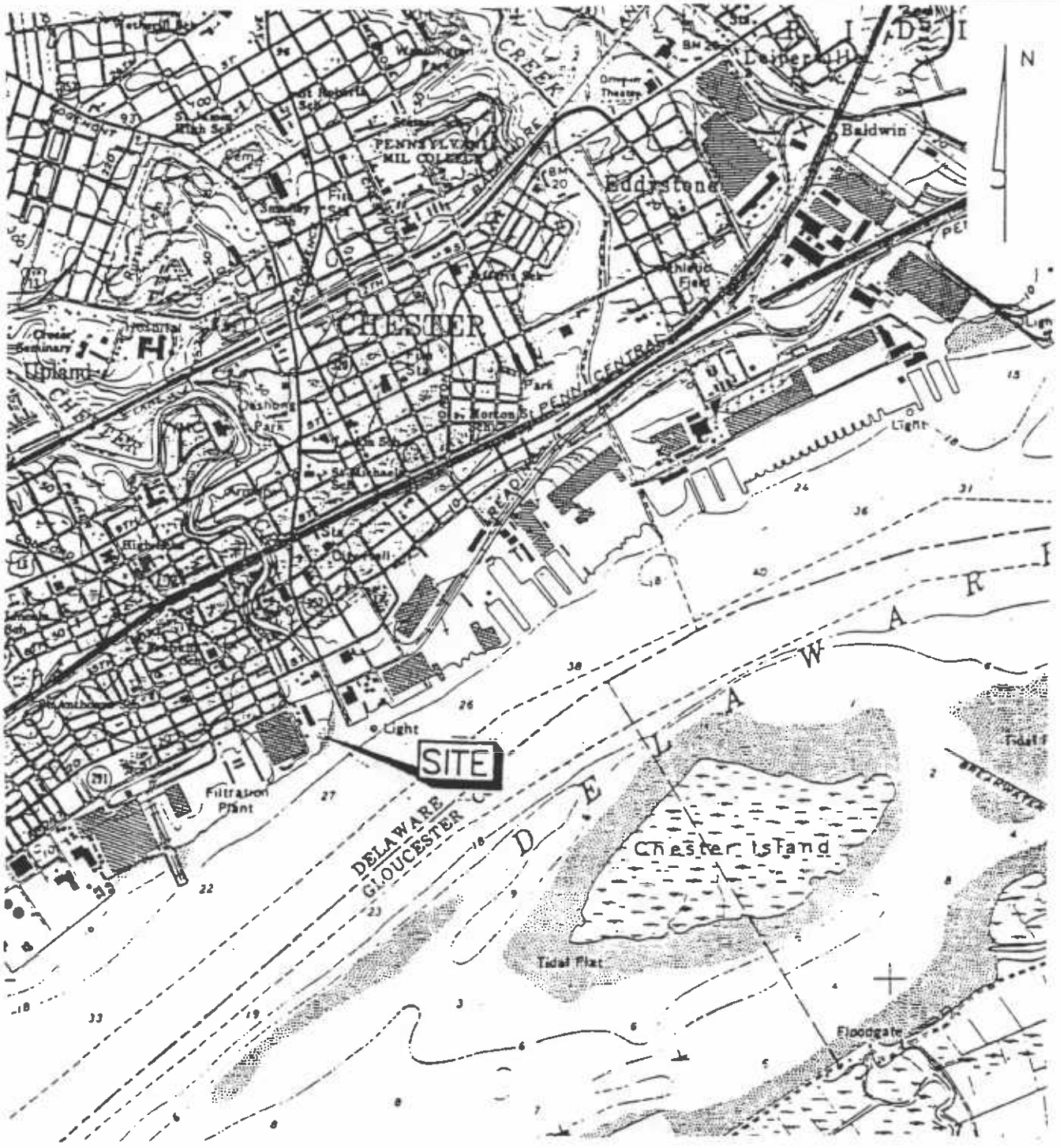
Parameter	MW-11	Recovery Well No. 1	Recovery Well No. 2	GW-1	Field Blank	Trip Blank
Benzene	5U	5U	5U	5U	5U	5U
Toluene	5U	5U	5U	5U	5U	5U
Ethylbenzene	5U	5U	5U	5U	5U	5U
Total Xylenes	5U	5U	5U	5U	5U	5U
Naphthalene	5U	5U	5U	5U	5U	5U

Concentrations in micrograms per liter (ug/l).
Samples collected by Roux Associates, Inc.
U=Not detected above detection limit.

Table 7. Groundwater Sample Results for Monitoring Well MW-1, July 1999; No. 2 Fuel Oil Area, Kimberly-Clark, Chester, Pennsylvania.

Parameter[1]	MW-1	Field Blank	Trip Blank
Benzene	0.3J	ND	ND
Toluene	ND	ND	ND
Ethylbenzene	ND	ND	ND
Isopropylbenzene (cumene)	1.5	ND	ND
Naphthalene	ND	ND	ND
Fluorene	2J	NA	NA
Phenanthrene	3J	NA	NA
Pyrene	ND	NA	NA
Chrysene	ND	NA	NA
Total xylenes	ND	ND	ND
Methyl tert-butyl ether	ND	ND	ND

Concentrations in micrograms per liter (ug/l).
[1]Parameters as specified by Act 2 Petroleum Shortlist for Fuel Oil Nos. 2, 4, 5, and 6, plus xylenes and MTBE.
J=Estimated concentration.
ND=Not detected above the method detection limit.
NA=Not analyzed.



BRIDGEPORT, NEW JERSEY
7.5 MINUTE QUADRANGLE
DELAWARE COUNTY, PA

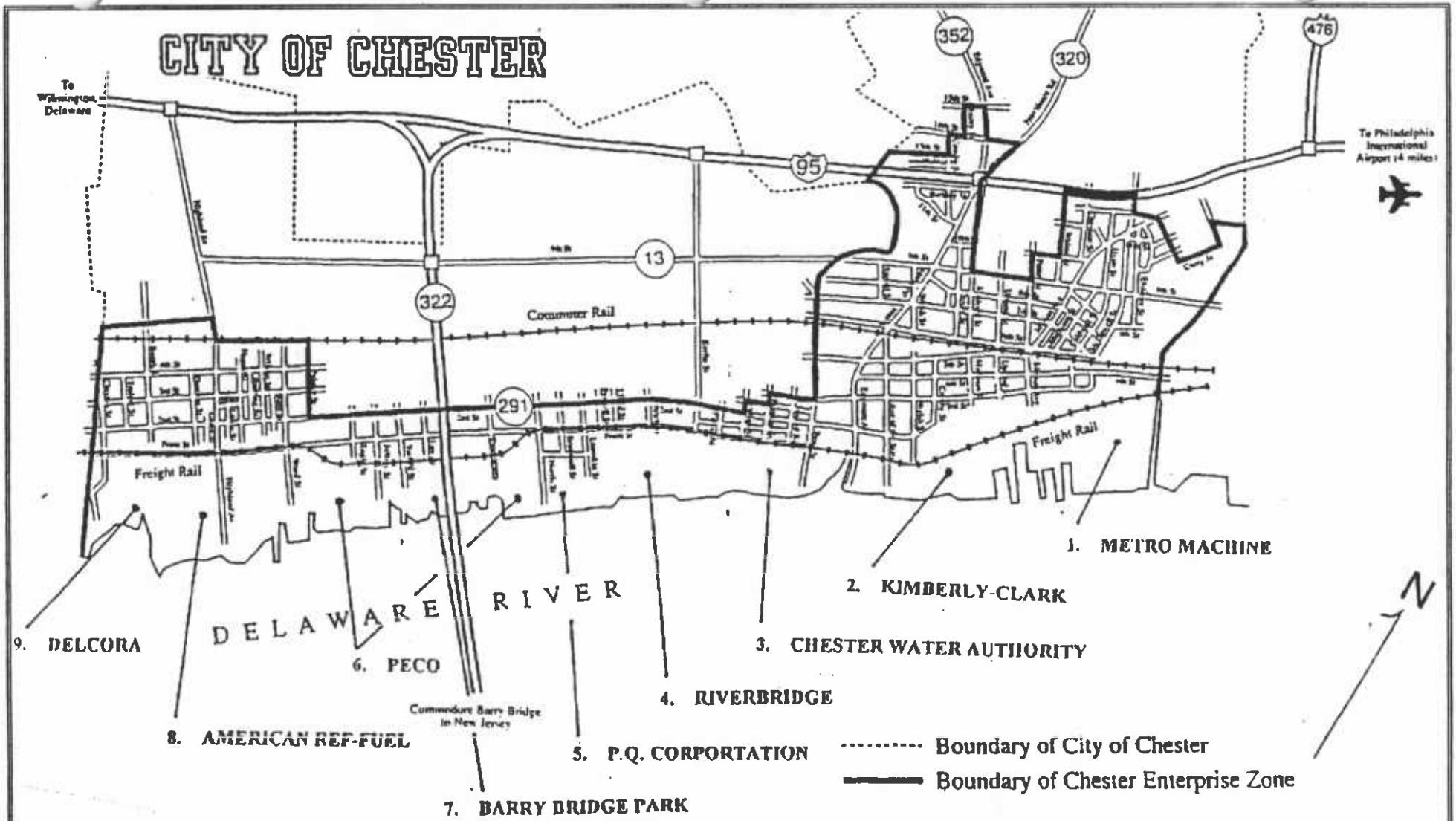
SCALE 1:24,000

FIGURE 1
Site Location Map
Kimberly-Clark
Front & Avenue of the States
Chester, Pennsylvania

ATLANTIC
ENVIRONMENTAL CONSULTING SERVICES, L.L.C.

PROJECT NUMBER: P4024

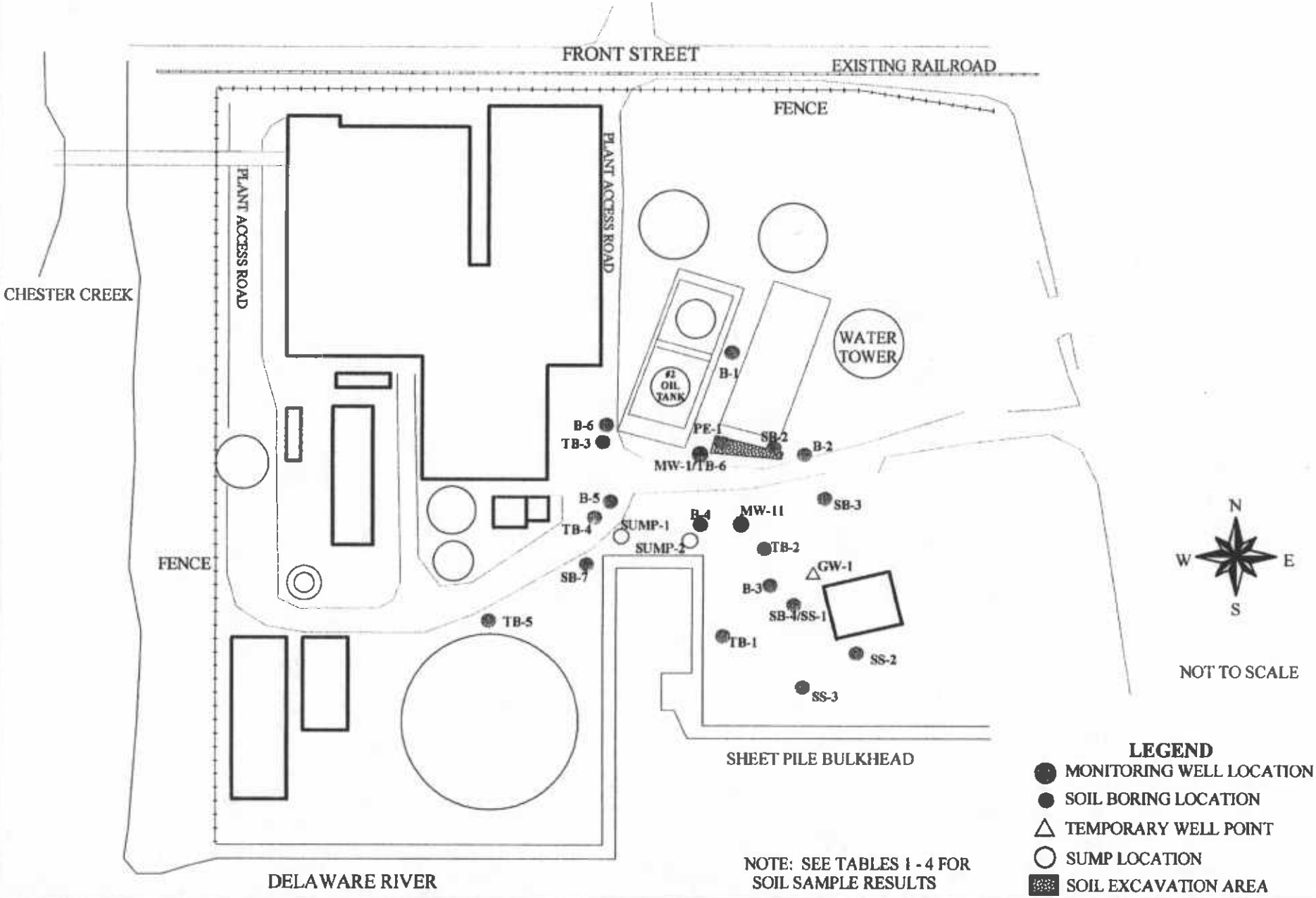
REVIEWED BY: SCH DATE: 3/24/99



Reproduced and modified from City of Chester Planning Commission Map

ATLANTIC ENVIRONMENTAL CONSULTING SERVICES, L.L.C.	KIMBERLY-CLARK, Chester, NJ	VICINITY MAP SHOWING SURROUNDING INDUSTRY

PROJECT MANAGER:	DESIGNED BY:	DRAWN BY:	CHECKED BY:	SCALE:	DATE:	PROJECT No.	FIGURE 2
TRH	TRH	CC	TRH	NONE	3/24/99	P4024	



ATLANTIC
Environmental Consulting Services, L.L.C.

SOIL SAMPLE LOCATIONS
NO. 2 FUEL OIL AREA
KIMBERLY-CLARK CHESTER, PA

FIGURE 3

APPENDIX A

Scott Paper Correspondence to PADEP
July 16, 1990

SCOTT

SCOTT WORLDWIDE

July 16, 1990

Ms. Kelly L. Kincaid
Hydrogeologist
Pennsylvania Dept. of
Environmental Resources
1875 New Hope Street
Norristown, PA 19401

RE: Scott Paper - Chester Operations
Oil Spill Remediation Plan

Dear Ms. Kincaid:

The purpose of this letter is to respond to the request outlined in your letter dated June 5, 1990 for a report concerning the extent of subsurface affected by the release of No. 2 fuel oil near the fuel oil storage area at the Chester Mill and a work plan to remediate the subsurface area near the spill. Please be advised that the results of the investigations outlined in this letter and the installation of the oil recovery system have been periodically discussed with Mr. Rich Breitenstein of your office and details noted on quarterly water quality inspection reports.

INTRODUCTION

In early January, 1989 a discharge pipe from one of the No. 2 fuel oil tanks (tank #4) was discovered to have ruptured ahead of the tank shut off valve. Immediately upon discovery, Scott personnel took steps to remove the remaining oil in the storage tank to enable the discharge pipe to be repaired to stop the leak. The volume of oil leaked into the containment area is not known. The discharged oil breached the containment berm and entered a gravel dry well nearby. After entering this dry well, it is believed that the oil then migrated along a storm sewer trench which discharges into a cove adjoining the Delaware River. Clean Harbors, Inc. of Deptford, NJ was immediately contacted to install containment and absorbent booms across the cove area to contain and capture the floating oil before it reached the main river channel. This method of oil recovery was approved and periodically monitored by the Coast Guard. Scott personnel then flushed the storm drain with water to remove oil which may have accumulated in the area. No further oil has been observed discharging from the storm sewer since the line was flushed. Both No. 2 fuel oil tanks were taken out of service, cleaned, and inspected for structural integrity. In addition the containment area around tank # 4 was repaired.

Scott personnel subsequently observed that during low tide or after heavy precipitation events, small quantities of oil entered the cove from the southern bulkhead area near the No. 6 fuel oil tank. Samples of this oil were tested, both by the Coast Guard and by an independent laboratory, to determine its

type. The oil was determined to be a light oil, most likely No. 2 fuel oil. Oil containment and clean up activities were maintained on a daily basis by Clean Harbors and Scott personnel. By the fall of 1989, the discharge to the river had discontinued. Triegel & Associates, Inc. was then contracted to conduct several investigations of the site to determine the nature, source, and extent of subsurface oil concentrations in the area near the fuel oil storage tanks and the cove. These investigations included:

(1) Exploratory soil boring investigation and installation of a ground water monitor well (Report dated November 9, 1989); and,

(2) Exploratory trench investigation (Report dated January 22, 1990).

Copies of these reports are attached for your review.

The findings of these subsurface investigations indicated that the petroleum concentration was limited in extent to the area immediately proximal to the bulkhead structure surrounding the cove. It was revealed that the majority of the free product migrates along voids in the low deck structure which adjoins the bulkhead. The southern wall of the bulkhead and low deck structure has deteriorated, allowing tidal action to create large void spaces directly beneath the low deck structure. The oil is believed to migrate through these void spaces and enter the cove area, particularly during low tide. Where present, the floating immiscible layer range from 1/4-inch to 3/8-inch in thickness. Samples of the floating product were collected and submitted for qualitative laboratory analysis. The laboratory identified the petroleum product as No. 2 fuel oil (see attached report).

At the time it was believed that the oil present in the subsurface was attributable to the release that occurred during the No. 2 fuel oil storage tank leak the previous January. It was also hypothesized that the oil may have been present in the soils and void spaces beneath the low deck structure for a long time and were periodically transported and released to the cove via tidal action. In early January, 1990 after a period of thawing and heavy rains, the discharge of oil from under the bulkhead recommenced. Guardian Environmental Services of Bear, DE was immediately contacted to conduct and maintain clean up activities on a daily basis until the discharge of oil subsided. Currently, Guardian maintains weekly maintenance on the containment and absorbent boom installation.

During excavation activities to install new equipment in the area near the fuel oil storage tanks, Scott personnel discovered No. 2 fuel oil leaking out of a 3/8-inch line connecting the No. 2 fuel oil pump house to the oil fill line from the barge

unloading station. The barge unloading pipeline has not been used for quite sometime to receive shipments of oil; however, the line must be tested periodically and the small line from the No. 2 fuel oil pumphouse was used to pressurize the larger line during these tests. The connection of the two lines became loose and the small line was not valved off at the pump house when not in use; thus, whenever No. 2 fuel oil was pumped to the mill, some oil was discharged to the subsurface area near the connection. The connection was immediately repaired and the 3/8-inch line valved off at the pump house. No. 2 fuel oil is only used to fire one of the paper machine hoods in the mill and only when natural gas is not available. The time of the year when No. 2 fuel oil is used is generally the December - February time frame, which is the time both in 1989 and 1990 when oil was discharged to the cove area.

It is believed that the leakage from this connection is the source of the oil release that observed to be discharging from the bulkhead area. The oil most likely accumulated behind the competent portions of the bulkhead located along the head of the cove, migrated laterally along the bulkhead, and released to the cove via voids in the bulkhead and the low deck structure along the southern portion of the cove.

GROUNDWATER REMEDIATION SYSTEM

A groundwater remediation system is currently being implemented to recover and treat ground water in the area of the oil release near the cove. A map of the site area showing the approximate location of the remediation system is illustrated on Figure 1. Chem-Sol Company, Inc. of Bryn Mawr, PA designed and will implement the groundwater remediation system. Triegel & Associates, Inc. will is providing technical direction for the design, implementation, and operation of the remediation system.

Groundwater will be recovered with two large diameter (24-inch) recovery wells installed along the western bulkhead wall, near the source of the free oil product. The approximate locations of the recovery wells are illustrated on Figure 1. The wells are constructed of 24-inch diameter, corrugated PVC sump pit with perforated shell, which is wrapped with filter fabric. A gravel pack consisting of 2.5-inch stone is backfilled around the wells. The wells were completed to a depth of 10 to 12 feet, approximately 4 to 6 feet below static groundwater level.

The oil recovery system consists of submersible pumps installed in the recovery wells. The pumps will withdraw water from the recovery well and transport it to an oil/water separator. The system is designed to treat influent at a rate of 100 gpm, with effluent concentrations generally below 10 ppm of petroleum

hydrocarbon compounds. Oil collected in the oil/water separator will be pumped to a small holding tank. The recovered oil will be used on-site for heat or power generation after being analyzed for the presence of contaminants. Effluent water from the oil/water separator will be discharged into a Utilities process water sump which will then be treated by a second oil/separator. The effluent from the existing Utilities oil/water separator is then mixed with the remainder of the plant's pretreated effluent which is then discharged to DELCORA. After the system is completely installed, a trial run will be conducted to verify the efficiency of the system and to make any necessary adjustments to maximize the system's performance.

Following the trial run and prior to full operation, samples of the oil/water separator effluent will be collected and submitted for total petroleum hydrocarbon (TPH) analysis to confirm that the system is working properly and to ensure that pretreatment levels for TPH's is not exceeded. After the start up of full system operation, effluent samples will be collected and analyzed on a weekly basis. In addition, oil recovery data will be recorded to evaluate the volume and rate of oil recovery.

Presently the installation of the oil recovery system is approximately 80% completed. Work orders for the installation and hook up of electrical power to the system's pumps have been written and the engineering to complete the electrical installation has begun. The majority of the system's piping has been completed. It is estimated that the final installation work will be completed within the next few weeks with system start up and check out in early August. The oil recovery system will be used to recover all free oil from the subsurface area as is practically possibly.

As for the soil contaminated with oil in this area, Scott plans to solicit proposals for in-situ bioremediation from a number of consultants experienced with this technology including Groundwater Technology, Inc. and Triegel & Associates. Specifications for these proposals will be given to prospective consultants by October 1, 1990 with comprehensive proposals due to Scott by December 1, 1990. Scott Engineering personnel will review proposals, select consultant, and submit detailed work plan to the Department by February 1, 1991.

If you have any comments or questions concerning the information presented in this letter, please contact me at (215) 499-6104.

Sincerely,

David R. Haldeman

David R. Haldeman
ENVIRONMENTAL SPECIALIST

Enclosures

cc: Mr. R. K. Anderson
Mr. R. Breitenstein - PADER - Norristown
Mr. M. M. Caron - Staff

bcc: Mr. W. R. Black
Mr. W. J. Lauer
Mr. J. W. Peiffer
Mr. R. S. Vitone
Mr. H. C. Waterbor

Note: bcc list gets letter only - if you want to see copies of the reports referenced in the letter, please advise DRH.

APPENDIX B

Subsurface Soils Investigation, No. 2 Fuel Oil Spill
Triegel & Associates, Inc.
November 1989

SUBSURFACE SOILS INVESTIGATION
No. 2 FUEL OIL SPILL
SCOTT PAPER COMPANY
CHESTER, PENNSYLVANIA, FACILITY

November 9, 1989

Prepared by: _____

John C. Bozner, P.E.#039491 - R

Reviewed by: _____

Gilbert J. Marshall, Geologist

Reviewed and editted by: _____

Dr. Elly K. Triegel, President

TABLE OF CONTENTS

1.0 INTRODUCTION AND BACKGROUND INFORMATION

This subsurface soils investigation was conducted at the request of Scott Paper Company for their Chester, Pennsylvania Facility. A map showing the location of this facility is included as Figure 1.

Scott Paper Company discovered a minor leak from the discharge line of a #2 fuel oil storage tank in February, 1989 (Figure 4). The leak originated upstream of the valve from a corroded portion of the discharge line. Upon their discovery, Scott Paper Company personnel immediately responded by pumping down the tank in order to greatly reduce or stop the leak. The duration of the pump-down was approximately 10 to 12 hours.

The spillage breached the containment berm and entered a gravel dry well installed in the underlying sediments in this area. After entering this dry well, it is believed that the oil then migrated along a storm sewer trench which discharges to a cove adjacent to the Delaware River (See Figure 2). Absorbent booms were set across the cove to mitigate the movement of oil to the Delaware River. Scott Paper Company then flushed the storm drain with water to remove any accumulated oil. No oil has been observed discharging from the storm sewer since the line was flushed. Reportedly, approximately 100 to 200 gallons of oil from the spill was recovered by Scott Paper Company during the activities described above. The quantity of total spillage is unknown. Scott Paper Company's method of oil containment and recovery has been monitored and approved by the U. S. National Coast Guard.

Scott Paper Company personnel have subsequently observed that, during low tide or following rain, small quantities of oil enter the Delaware River through bulkheads forming the cove. Although oil from the spill had been controlled from entering the cove of the Delaware River and a major portion of the oil had apparently

been remediated, there was some evidence of oil contamination in this area. The absorbent booms are still maintained to recover any residual oil which may enter the cove.

Scott Paper Company contracted Triegel & Associates, Inc. (TAI) to perform a subsurface soils investigation in order to: (1) define the extent of contaminated subsurface materials; (2) determine magnitudes of contamination; and (3) install any necessary monitoring wells to monitor ground water quality at the site. The wells may also be used for product recovery, if necessary.

2.0 METHODS

The objectives of the field investigation were to delineate the extent of subsurface contamination by No.2 fuel oil and implement appropriate monitoring/mitigation measures, if necessary. The following tasks were proposed to carry out these objectives: describe split spoon samples in detail, note any visible oil contamination, perform field testing for the presence of volatile organic compounds, collect samples for laboratory analyses, and select the location(s) for any necessary ground water monitoring/recovery well(s).

The site investigation was conducted on October 3, 1989, and consisted of drilling six test borings, designated TB-1 through TB-6. The test borings were drilled to depths ranging from 10 to 16 feet utilizing continuous flight, hollow-stem auger drilling techniques. Test boring locations were selected based on the details of the spill incident reported by Scott Paper Company and subsequent observations made during the investigation conducted by TAI personnel.

An attempt was made to continuously sample soils with a standard, driven, split-spoon sampler, in accordance with ASTM D-1586. A sample was obtained for every 2 feet of penetration and jarred for

field organic vapor screening. Each hole was logged in detail (see Appendix 1) and any visible oil contamination noted. Soil samples were selected to be retained for laboratory analyses based on the results of the organic vapor screening and visual descriptions. The vapor screening was accomplished in the field with a portable OVA/GC (Organic Vapor Analyzer/Gas Chromatograph). The OVA/GC analyses used jarred, sealed soil samples and were performed on the head-space (air portion of the jar).

Since fuel oil is immiscible in water and is of a lower specific gravity than water, it will tend to form a layer on top of the ground water surface. Because of this fact, soil samples were collected at or near the top of the water table from each boring for laboratory testing for total petroleum hydrocarbon compounds (EPA Method 418). Sample selection for laboratory analyses was also based on visual observations of oils within the soil samples.

These analyses were performed to aid in the delineation of the petroleum hydrocarbon contamination and to provide quantitative data on the concentration of hydrocarbons in the soils.

3.0 RESULTS OF THE INVESTIGATION

3.1 SUBSURFACE SOILS INVESTIGATION

3.1.1 Nature of the Deposits

Based on discussions with Scott Paper personnel, it was reported that the cove shown on Figure 2 once extended farther west, beyond the locations of test borings TB-3 and TB-6. A portion of the cove was backfilled to its present position, at some unknown time, with material similar to that which was encountered in test borings TB-3 and TB-6. Cross-section A-A' (Figure 4) illustrates the site's general stratigraphy as indicated by the field investigation and

reports of prior site development. The location of the transect for cross-section A-A' is shown on Figure 3.

Test borings TB-1 and TB-2, located in the eastern portion of the study area, encountered approximately 8 feet of loose fill (clayey silt with rock, brick, and coal fragments) above dark gray, naturally occurring silt. The silt contains thin layers of vegetal matter, parallel to thin bedding laminations.

In the north-central portion of the area under investigation, TB-3 and TB-6 encountered fill (silt/clay with rock and brick fragments) throughout their depths.

To the west, TB-4 and TB-5 encountered approximately 8 feet of fill above wood and oyster shell debris. Large voids were encountered in the wood and oyster shell debris at these locations.

3.1.2 Results of Field Organic Vapor Screening

As was mentioned earlier in the text, a representative portion of each two-foot drive sample was placed in a sealed glass jar for organic vapor screening using an OVA/GC. Total organic vapor concentrations were recorded and are tabulated on the Field OVA Reporting Forms (see Appendix 2).

Each soil sample was placed in a glass jar and a portion of the headspace vapor was injected into the OVA. A total organic vapor concentration of more than 1000 parts per million (ppm) was measured in a number of these samples. In all of the samples, however, the GC analyses indicated that only one large peak, with a very short retention time, was present. This type of GC pattern is typical of naturally occurring volatile organics (e.g., methane, ethane). Hence, it was concluded that naturally occurring background concentrations of volatile organic compounds are very high, due to the organic nature of the sediments.

Maximum vapor concentrations, as indicated by the OVA, were generally found for soil samples collected between 4 and 8 feet below existing grade. No GC peaks corresponding to fuel oil-related volatile compounds (e.g. benzene, toluene, ethyl benzene) were found at the detection limit of approximately 10 ppm. It should be noted that this detection limit is higher than normal, due to the high concentrations of naturally occurring volatile organics. Other petroleum hydrocarbons, however, were detected in laboratory analyses (see Section 3.1.3). It should be noted that No. 2 fuel oil (diesel) is primarily composed of carbon compounds ranging from C_8 to C_{40}, the majority of which would not be detected by the OVA/GC.

3.1.3 Results of Laboratory Testing

Soil samples analyzed in the laboratory were found to contain between 180 and 8900 ppm of total petroleum hydrocarbon compounds (see Appendix 3).

A number of these samples were also noted to have visual and/or olfactory indications of oil contamination. Table 1 provides a summary of the laboratory results, and the corresponding test boring numbers, soils descriptions, and total head-space organic vapor concentrations.

3.2 GROUND WATER MONITORING

Because of the very limited areal extent of subsurface contamination which was visually observed in the soil samples (see Figure 2), and the numerous restrictions in that area (overhead and underground utilities, building structures, etc.), only one ground water monitoring well was installed.

The ground water monitoring well was installed at the location of

TB-6. It should be noted that this location (TB-6) is the only area at which significant visible oil contamination was observed. The well completion diagram is included in this report as Figure 5. The well screen was placed to intercept the range of anticipated water level fluctuations, the top of the screen being above the anticipated high water level.

On October 12, TAI personnel measured the thickness of the product layer and sampled the groundwater for laboratory analyses. The thickness of the product layer was measured to be 3/8 inches. The groundwater was analyzed for benzene, toluene, ethyl benzene, xylene, and petroleum fuels in groundwater (EPA Method 602, Purgeable Aromatics). The results of these laboratory analyses are presented on the following page with corresponding recommended U.S. EPA Drinking Water Standards or other criteria.

It is the conclusion of the laboratory, based on their gas chromatographic analysis of the ground water sample, that the petroleum hydrocarbons detected in the water samples corresponded to weathered No. 2 fuel oil. The final laboratory report is included in Appendix 4.

Benzene was the only compound detected above current U.S. EPA Drinking Water Standard concentration. These standards apply only to public drinking water supplies (which is not the case at this site) and are used in this context only for comparison purposes. The slightly elevated benzene concentration is believed to be attributed to the No. 2 fuel oil spill and the areal extent of the contaminated ground water should be coincident to that shown on Figure 2. No wells that furnish water for potable purposes are known to be down-gradient or in the vicinity of this site. The elevated concentration is near drinking water standards and the only anticipated fate of the compound is eventual discharge to the Delaware River, which will greatly dilute the contaminated discharging ground water.

LABORATORY GROUND WATER ANALYSES			
COMPOUND	GROUND WATER CONCENTRATION (ppb)	U.S.EPA DRINKING WATER STANDARD/GOAL*	
		MCL	MCLG
Petroleum Fuel in Water	15	--	--
Benzene	20	5	--
Toluene	20	--	2000
Ethylbenzene	80	--	680
Total Xylene	370	--	440

*Please note that U.S. EPA Drinking Water Standards are reported for Benzene as Maximum Contaminant Levels (MCL) and for the remaining compounds as Maximum Contaminant Level Goals (MCLG). MCLG's are provided for those compounds for which federally regulated standards have not been established.

4.0 SUMMARY OF CONCLUSIONS

Since contamination should be vertically bound by floating of the oil on top of the ground water table, the field observations and field/laboratory test results for soil samples collected at the top of the water table were used as a basis for delineating the aerial extent of the No.2 fuel oil contamination from the spill. This aerial extent is illustrated in Figure 2.

Test borings TB-1 and TB-4 penetrated materials thought to be relatively free of contamination. OVA/GC results are near background levels, no visual petroleum contamination was noted from split-spoon samples, and total petroleum hydrocarbons (from laboratory testing) are relatively low.

In TB-3, petroleum contamination was not observed during split spoon sample collection and laboratory testing indicated relatively very low total petroleum hydrocarbon compound concentrations, even though OVA/GC results were relatively high. Hence, we believe that the material penetrated by TB-3 is beyond the area of contamination of the spill. High organic vapor concentrations are probably the result of naturally generated volatiles from the decomposition of vegetation within the fill.

TB-2 is thought to be very near the area of contaminated subsurface materials, as evidenced by visual observation during split-spoon sample collection and moderately high total petroleum hydrocarbon compound concentrations.

TB-6 was located within the limits of the contaminated area, as evidenced by large quantities of oil observed during drilling and sampling and very large petroleum hydrocarbon compound concentrations as determined by the laboratory.

An anomolous laboratory test result was reported for a sample collected from TB-5 at a depth of 8 to 10 feet below existing grade. The total petroleum hydrocarbon compound concentration was determined to be 8900 ppm, the highest concentration determined during this investigation. We believe this analysis is due to subsurface conditions unrelated to the No.2 fuel oil spill, for the following reasons:

(1) TB-5 is the farthest boring from the spill area (over 200'), and is located in another portion of the facility;
(2) the intervening borings (TB-4 and TB-3) are relatively clean;
(3) the sample from TB-5 did not contain visible evidence of oil contamination; and
(4) it is expected that shallow ground water flow is directly from the spill location to the river, and would be unlikely to flow in the direction of TB-5 (to the west).

We would expect that, if the elevated concentration discovered in the sample from TB-5 was associated with the No. 2 fuel oil spill, the samples collected from TB-3 and TB-4 would have also exhibited elevated concentrations. This is based on the fact that apparent subsurface hydrological connections exist between TB-6, TB-3, TB-4, and TB-5 (see Figure 4 and note potential high permeability afforded by subsurface materials between borings).

For the aforementioned reasons, the laboratory result for soil from TB-5 was not considered in the development of the contamination delineation shown on Figure 2. The source(s) of the elevated concentrations determined from the sample of TB-5 is unknown at this time.

As discussed in Section 3.2 of this report, a ground water monitoring well was constructed at the location of TB-6. Ground

water samples were collected and analyzed for petroleum fuel in water and for BTEX (benzene, toluene, ethylbenzene, and xylene). The results of the laboratory analyses are shown on the table on Page 7. Benzene was the only compound detected (at 20 ug/L) above the current U.S. EPA Drinking Water Standard concentration. As discussed previously, the benzene is probably associated with the fuel oil spill, but is present at low concentrations, in a limited area. The slightly elevated concentration, the estimated aerial extent of the elevated concentration, and the fate of the contaminant have been discussed in more detail in Section 3.2, Page 8 of this report.

5.0 RECOMMENDATIONS

Using a measured product thickness of 3/8 inches (as observed from TB-6), the delineated area as shown on Figure 2, and a conservative porosity estimate of 50%, it is estimated that approximately 600 to 700 gallons of product may be present in the subsurface materials at the site. This quantity estimate is based on assumptions derived from the data gathered during this investigation and should be considered conservative. The permeability of the subsurface materials was estimated to be approximately 10^{-4} centimeters per second. This approximation was based on the grain-size of the sediments and ground water recovery observations. The amount which may be recovered cannot be quantified at this time. However, due to the low permeability of the deposits, and the tendency for the oil to adsorb onto the fine-grained subsurface materials, the quantity of fuel oil that can be recovered by pumping can be expected to be considerable less than the total amount spill, even using aggressive recovery techniques.

Two remedial alternatives are possible: (1) recover product from the subsurface by pumping, and (2) continue, for the long term,

recovering the product with the existing absorbant booms. The latter method would not recover dissolved components of the fuel oil. Due to restrictions imposed by overhead and underground utilities, and by existing plant structures (buildings, piping, etc.), it is believed that remediation of soils contamination via excavation is impractical at this site.

5.1 FIRST ALTERNATIVE

From observations made during the development and ground water sampling of TB-6, infiltration into the well from the surrounding subsurface materials is relatively slow, with full recovery of that well requiring approximately 30 minutes. If this alternative for remediation is selected, a pump, automatically capable of intermittent pumping, set to a depth at or below static water levels (considering natural ground water fluctuations), should be the most efficient system.

5.2 SECOND ALTERNATIVE

The second remedial option, consisting of continued recovery of oil with absorbant booms already deployed in the cove, is a viable method of recovering the oil at this site. We recommend that the product layer thickness, as measured from TB-6, be monitored by Scott Paper Company personnel on a set frequency (such as once every month). A product layer thickness of zero inches for at least three consecutive readings would indicate that the source of the oily contamination has been depleted. These observations could support observations of diminished contamination within the cove and the decision to retire the absorbant booms. If this alternative is selected as the sole remediation method, its duration should be lengthy. This method will not recover dissolved components of the oil, but these compounds are not present at significant concentrations, and would be expected to

diminish over time due to natural biodegradation and dilution with recharge. Periodic ground water sampling and analyses may also be performed to confirm decreasing dissolved contaminant concentration levels.

oOo

TABLE 1
SOIL SAMPLE LABORATORY ANALYSES.

SAMPLE NUMBER	HOLE NUMBER	DEPTH FROM EXISTING SURFACE (ft)	SUBSURFACE MATERIAL DESCRIPTION	MAXIMUM FIELD OVA READING (ppm)	LABORATORY TOTAL PETROLEUM HYDROCARBON COMPOUNDS (ppm)
B-1D	TB-1	6-7	Pea to 3/4" Gravel, Rndd, V Wet; Wood Frags on Top	610	430
B-2E	TB-2	8-10	Silt, V Dk Gr to Gr; Some Organic or Root Matted Lamins; Wood @ Bottom.	> 1000	750
B-3E	TB-3	8-10	V Wet Silt, V Dk Gr to Gr, Fairly Clean, Continuous	> 1000	180
B-4C	TB-4	10-12	Very little soil recovered; Much wood recovered; could not distinguish in-place soil from cave material; l'void @ Bot.	610	570
B-5E	TB-5	8-10	Silt, V Dk Gr w/ Abundt wood & Oyster Shell Frags. Silt, Gr @ bottom 2".	840	8900
B-6E	TB-6	8-10	Fill; Gravel and Silt Matrix. Visual Petroleum Contamination.	> 1000	3900

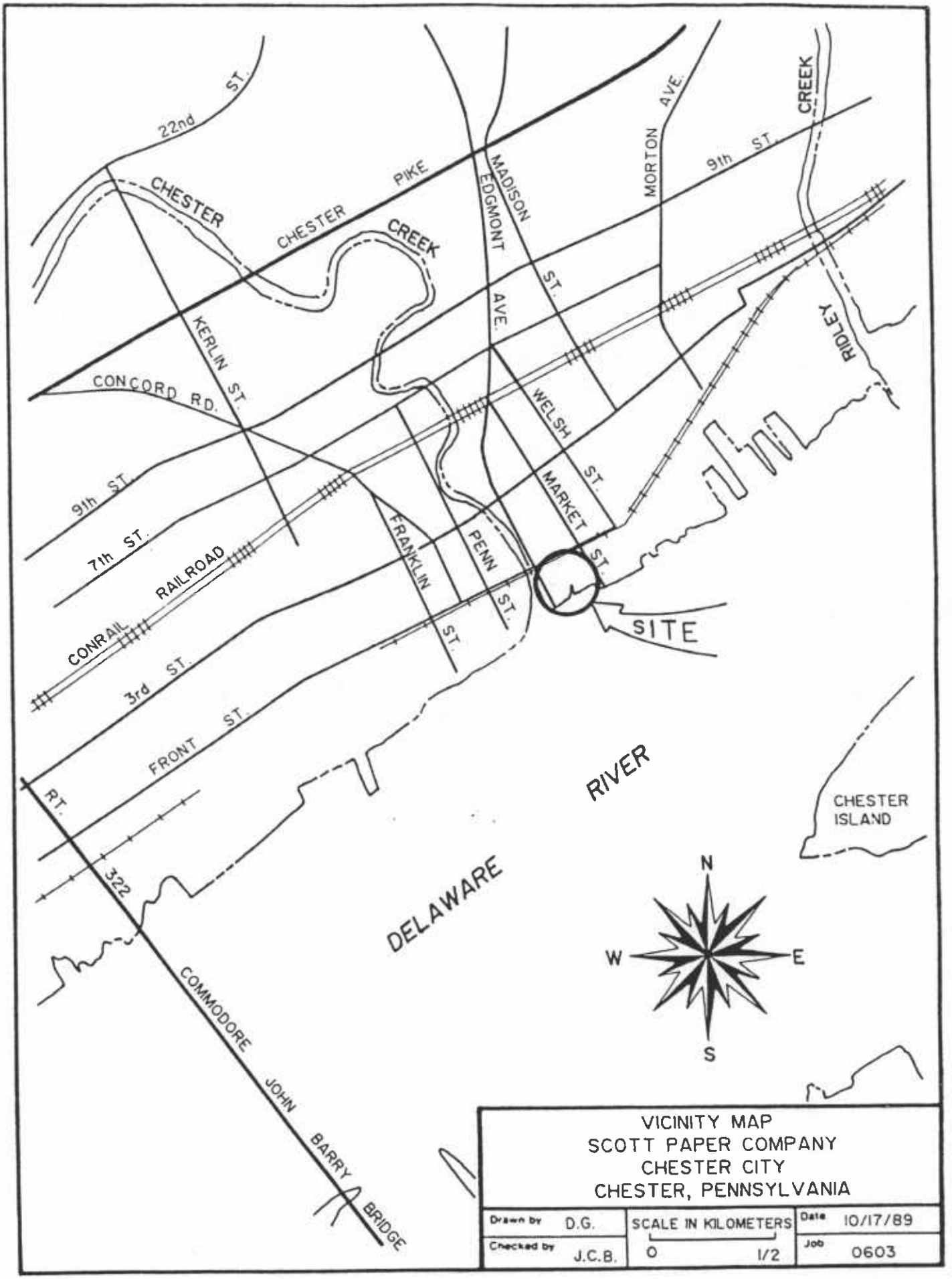
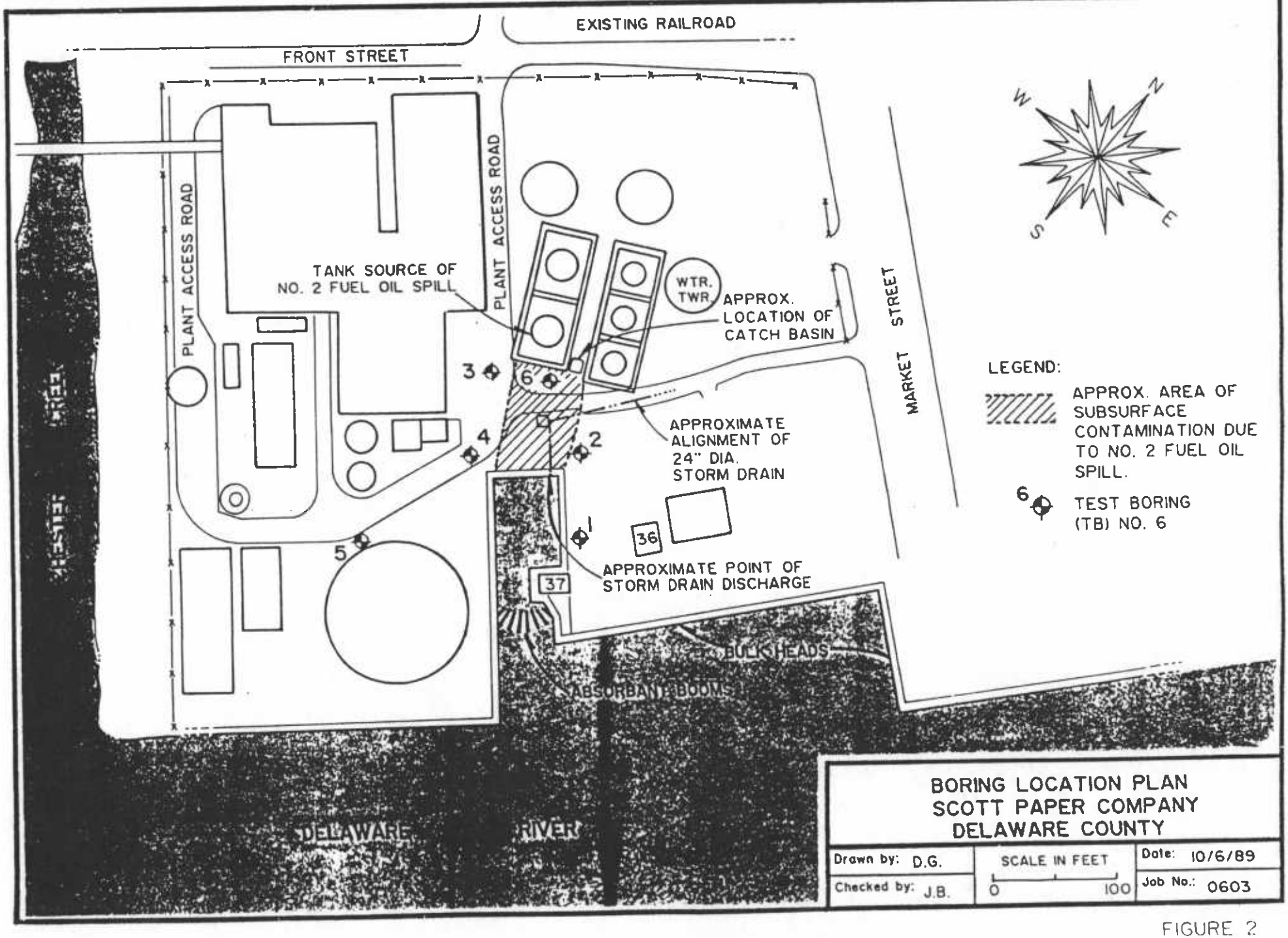

22nd ST.
CHESTER PIKE
CHESTER CREEK
MADISON EDGMONT AVE.
MORTON AVE.
9th ST.
CREEK
KERLIN ST.
CONCORD RD.
WELSH ST.
MARKET ST.
RIDLEY
9th ST.
7th ST.
RAILROAD
CONRAIL
FRANKLIN ST.
PENN ST.
SITE
3rd ST.
FRONT ST.
RT. 322
RIVER
CHESTER ISLAND
DELAWARE
N
W
E
S
COMMODORE JOHN BARRY BRIDGE
VICINITY MAP
SCOTT PAPER COMPANY
CHESTER CITY
CHESTER, PENNSYLVANIA
Drawn by D.G.
Checked by J.C.B.
SCALE IN KILOMETERS
0 1/2
Date 10/17/89
Job 0603

FIGURE 1

TRIEGEL & ASSOCIATES, INC.

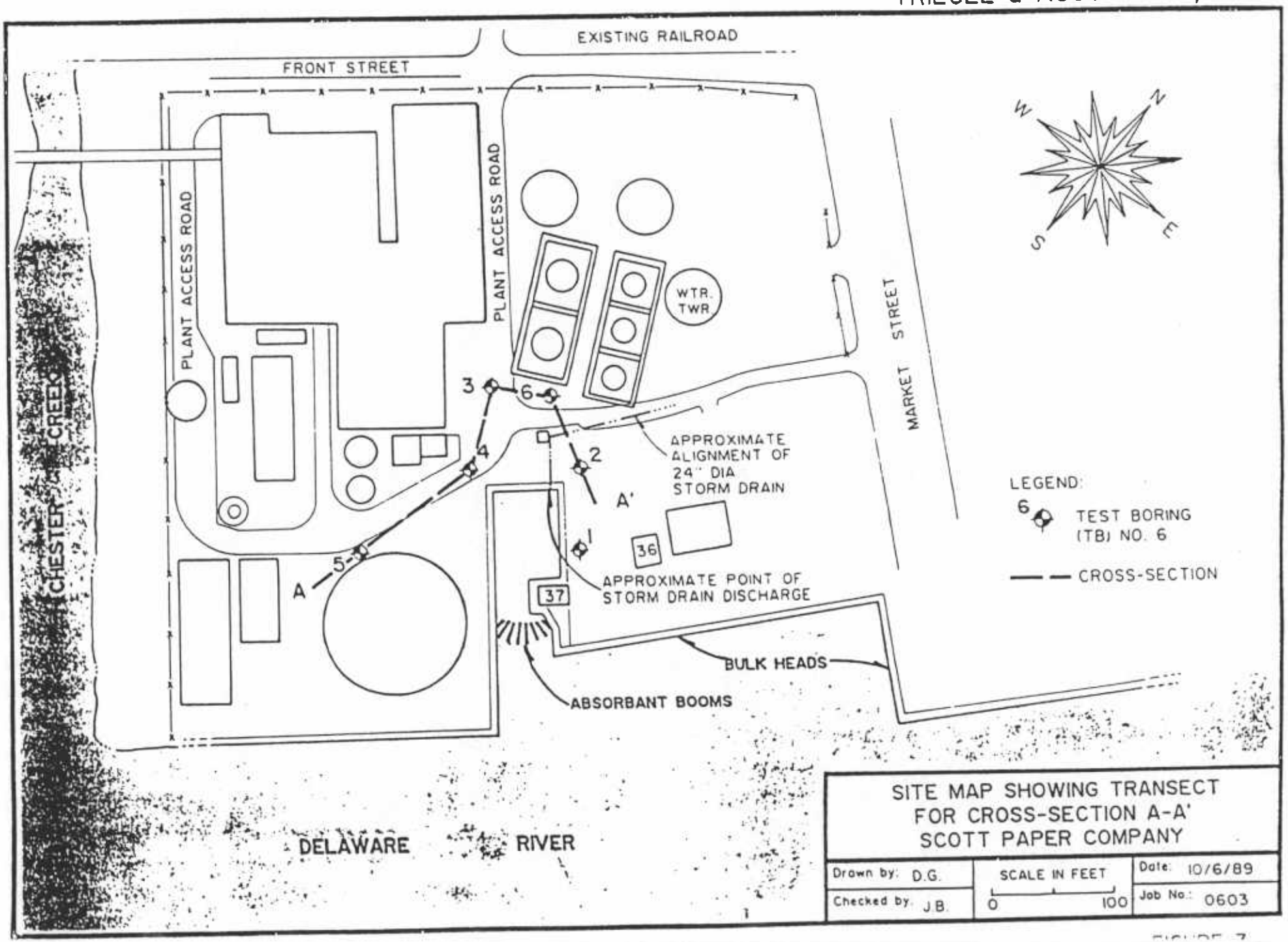


BORING LOCATION PLAN
SCOTT PAPER COMPANY
DELAWARE COUNTY

Drawn by: D.G.	SCALE IN FEET 0 100	Date: 10/6/89
Checked by: J.B.		Job No.: 0603

FIGURE 2

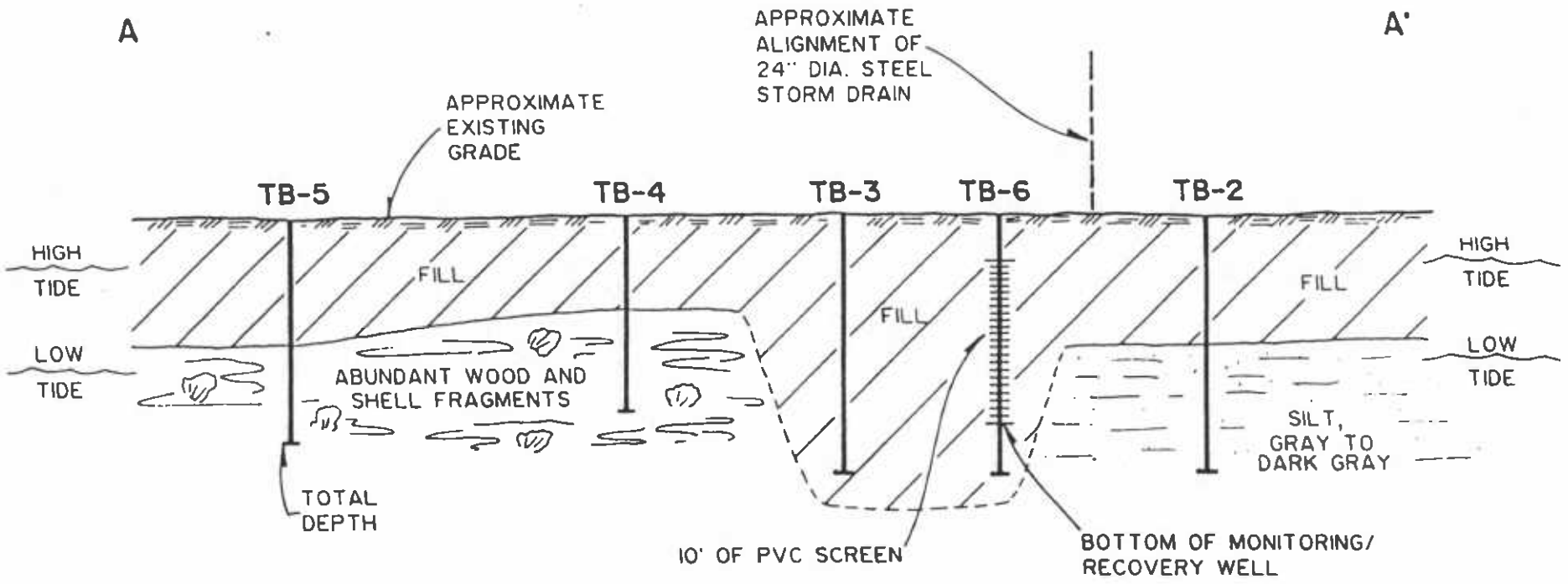
TRIEGEL & ASSOCIATES, INC.



SITE MAP SHOWING TRANSECT
FOR CROSS-SECTION A-A'
SCOTT PAPER COMPANY

Drawn by: D.G.	SCALE IN FEET	Date: 10/6/89
Checked by: J.B.	0 100	Job No.: 0603

FIGURE 7



VERTICAL SCALE: 1" = 10'
HORIZONTAL SCALE: 1" = 50'

LEGEND:

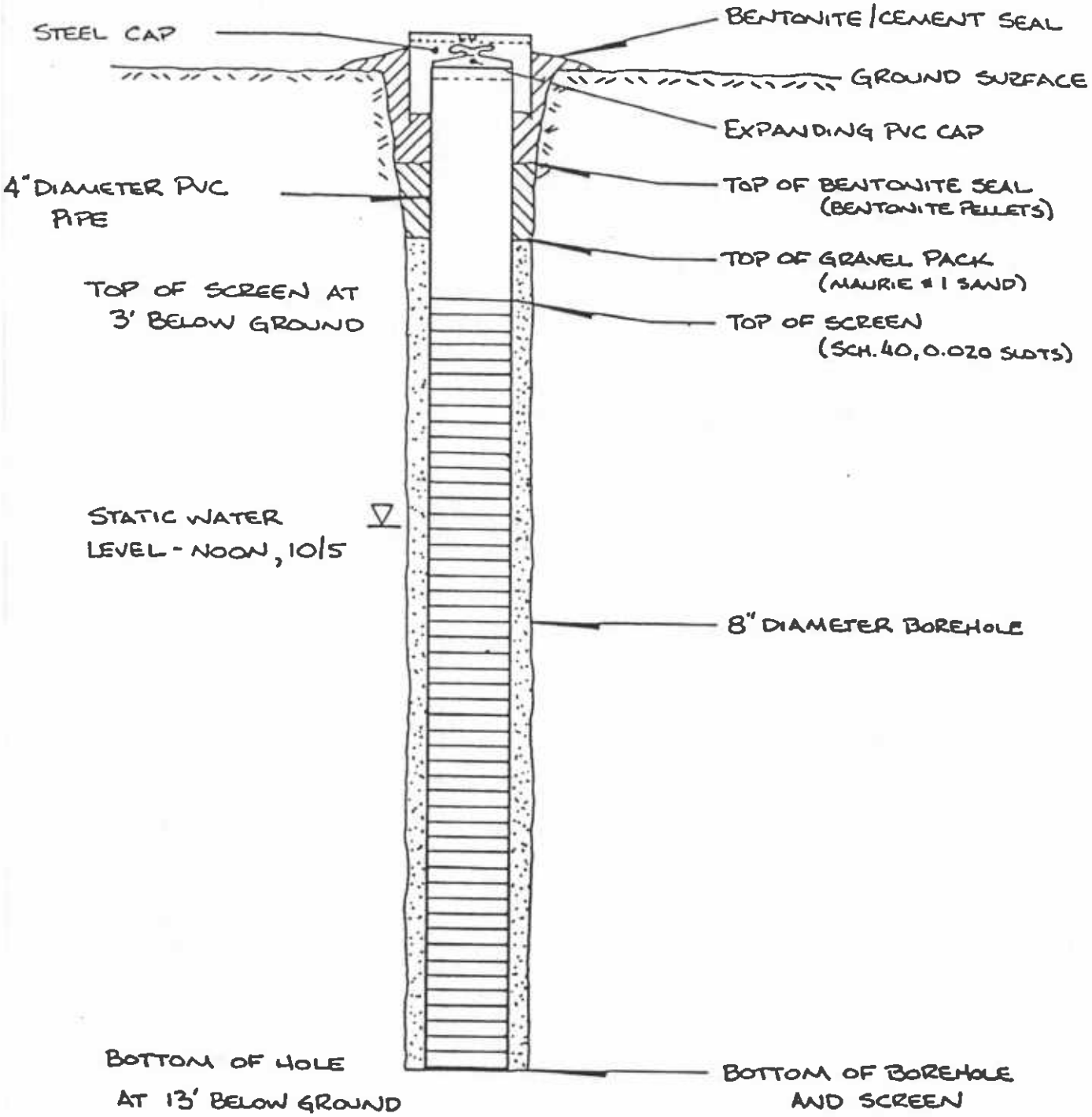
TB-5 = TEST BORING NO. 5

SCHEMATIC CROSS-SECTION A-A'
SCOTT PAPER COMPANY
DELAWARE COUNTY, PENNSYLVANIA

Drawn by: D.G.		Date: 10/18/89
Checked by: J.B.		Job No: 0603

FIGURE 5

WELL COMPLETION DIAGRAM
BOREHOLE #6



VERTICAL SCALE: 1" = 2'

APPENDIX 1
TEST BORING LOGS

TRIEGEL & ASSOCIATES, INC.
Borehole Number: 1
Surface Elev.(Ft/MSL): _____

Borehole Diam. 8 in., From 0 To 10
____ in., From ____ To ____
Total Depth: 10
Depth to SWL: _____ (ft)
Date SWL Measured: _____, _____

Drilling Meth: Auger
Date Drilled: 10/3/89
Drilled By: Test Well
Logged By: JCB
County: Delaware
Township or Munic. ___
Chester.
State: Pennsylvania
After Drilling

DEPTH (FT)	OVA (ppm)	OTHER TESTS (SPT's)	DESCRIPTION OF STRATUM
1	600	7,8,8,10 30% REC	Fill, Clay/Silt/Gravel Mix; Some Blk Clay
2			
3	220	6,7,7,8 0% REC	Aug. Flight Sample-- Clay/Silt, V Wet, V Dk Gr To Lt
4			Brn;Some Gravel & Rd Brick Frags
5	100	2,3,6,7 50% REC	Silt, Brn to V Dk Gr; Some Brick Frags @ Bottom
6			
7	610	17, 100 50% REC	Pea to 3/4" Gravel, Rndd, V Wet; Wood Frags on Top
8			Driller Reported Penetrating Refusal Layer @ 8'
9			
10	>1000	1,0,1,1	Silt, V Wet, Dk Gr to V Dk Gr, Soft Continuous

NOTES:

TRIEGEL & ASSOCIATES, INC.
Borehole Number: 2
Surface Elev.(Ft/MSL): _____

Borehole Diam. 8 in., From 0 To 16
____ in., From ____ To ____
Total Depth: 16
Depth to SWL: 2.5 (ft)
Date SWL Measured: 10/3/89 , _____

Drilling Meth: Auger
Date Drilled: 10/3/89
Drilled By: Test Well
Logged By: JCB
County: Delaware
Township or Munic. Chester
State: Pennsylvania
After Drilling

DEPTH (FT)	OVA (ppm)	OTHER TESTS (SPT's)	DESCRIPTION OF STRATUM
1	>1000	12,13,12,13 80% REC	Fill; Sand/Silt/Gravel Mix; Rd Brick and Coal Frags.
3	>1000	8,6,5,5 50% REC	Fill; Sand/Silt/Clay Mix, Lt Brn; Some Coal and Rock Frags.
5	100	6,5,2,1 5% REC	Fill; Clay; Some Rd Brick Frags; Slight Petroleum Odor.
7	480	5,4,1,1 0% REC	Another attempt was made to collect a sample. Attempt was unsuccessful. Slight Petroleum Odor and Residue.
9	>1000	4,10,2,1 80% REC	Silt, V Dk Gr to Gr; Some Organic or Root Matted Lamins; Wood @ Bot
11	>1000	1,0,1,0	Silt, Gr to Dk Gr, Natural;Slight Petroleum Odor (Surface of samples has slight petroleum odor, internally OK)
13	>1000	1,0,0,0	Silt, Gr to Dk Gr, Natural;Slight Petroleum Odor as above
15	>1000	not performed	Auger Flight Sample Clean Silt Dk Gr, Continous

NOTES:

TRIEGEL & ASSOCIATES, INC.
Borehole Number: 3
Surface Elev.(Ft/MSL): _____

Borehole Diam. 8 in., From 0 To 16
____ in., From ____ To ____
Total Depth: 16
Depth to SWL: 6 (ft)
Date SWL Measured: 10/3/89 , _____

Drilling Meth: Auger
Date Drilled: 10/3/89
Drilled By: Test Well
Logged By: JCB
County: Delaware
Township or Munic. ___
Chester
State: Pennsylvania
After Drilling

DEPTH (FT)	OVA (ppm)	OTHER TESTS (SPT's)	DESCRIPTION OF STRATUM
1	30	15,7,7,19 50% REC	Sand/Gravel Fill; Some Rd Brick Frags ; Some Oil Staining
3	80	13,7,13,17 5% REC	Fill, Some Rd Brick Frags
5	360	19,7,3,3 30% REC	Clay/Silt Fill; Some Rd Brick Frags
7	420	4,4,4,4	Wet, same as above
9	>1000	0,1,1,1 60% REC	V Wet Silt, V Dk Gr to Gr, Fairly Clean, Continuous
11	>1000	1,2,1,2 50% REC	Silt, V Wet, V Dk Brn to Blk; Some Rock Frags.
13	>1000	1,1,2,2 75% REC	Silt, V Wet, V Dk Brn to Blk, Some Rock Frags.
15	940	6,2,2,2 50% REC	Silt, V Wet, V Dk Brn to Blk;Some Rock Frags.

NOTES:

TRIEGEL & ASSOCIATES, INC.
Borehole Number: 4
Surface Elev.(Ft/MSL): _____

Borehole Diam. 8 in., From 0 To 12
_____ in., From _____ To _____
Total Depth: 12
Depth to SWL: _____ (ft)
Date SWL Measured: _____, _____

Drilling Meth: Auger
Date Drilled: 10/3/89
Drilled By: Test Well
Logged By: JCB
County: Delaware
Township or Munic. Chester
State: Pennsylvania
After Drilling

DEPTH (FT)	OVA (ppm)	OTHER TESTS (SPT's)	DESCRIPTION OF STRATUM
1			Dry Rubble and Sand/Silt Matrix, Dk Brn *Did not attempt drive sample from 0 to 4 feet because of suspected pressurized water line.*
2			
3			
4			
5	0.6	4,4,4,3 100% REC	Fill; Sand/Silt Mix, Blk to Brn; Num Small Rock Frags.; no petroleum odor noted.
6			
7	11	5,3,2,2 10% REC	Fill; Small Rock Frags, Blk, V Wet; Abundt Wood; Appears clean.
8			
9		62,6,4,3 (wood)	Wood recovered--Soil below not recovered; Appears clean.
10			
11	610	4,44,-,-	Very little soil recovered; Much wood recovered; could not distinguish in-place soil from cave material; 1'void @ Bot.
12			

NOTES:

TRIEGEL & ASSOCIATES, INC.
Borehole Number: 5
Surface Elev.(Ft/MSL): _____

Borehole Diam. 8 in., From 0 To 14
___ in., From ___ To ___
Total Depth: 14
Depth to SWL: 6 (ft)
Date SWL Measured: 10/3/89, _____

Drilling Meth: Auger
Date Drilled: 10/3/89
Drilled By: Test Well
Logged By: JCB
County: Delaware
Township or Munic. ___
Chester
State: Pennsylvania
After Drilling

DEPTH (FT)	OVA (ppm)	OTHER TESTS (SPT's)	DESCRIPTION OF STRATUM
1	0.8	no blow counts recorded* 50%REC	Fill;Gravel w/ Dk Brn Silt Matrix
3	200	7,10,17,20 50%REC	Fill;Gravel/Sand/Silt Mix;Some Rd Brick Frags.
5	260	60/3" 100%REC	Rubble (Rock and Brick) @ 5-6'; Slight Petroleum Odor; Drilled to 6', through rubble.
7	6	8,2,2,3 50%REC	Same fill as above on top. Silt, Gr, th lamin @ bottom 2".
9	840	2,5,5,3 70%REC	Silt, V Dk Gr w/ Abundt wood & Oyster Shell Frags. Silt, Gr @ bottom 2".
11	160	2,3,21,17 70%REC	Wood & Oyster Shell Frags w/ Gr Silt Matrix; Appears Clean.
13	340	10,10,10,11 0%REC	Attempted to recover a sample the second time. Recovered Silt,V Dk Gr w/ wood and oyster shell Frags. Appears Clean.

NOTES:

TRIEGEL & ASSOCIATES, INC.
Borehole Number: 6
Surface Elev.(Ft/MSL): _____

Borehole Diam. 8 in., From 0 To 16
____ in., From ____ To ____
Total Depth: 16
Depth to SWL: 6 (ft)
Date SWL Measured: 10/3/89, _____

Drilling Meth: Auger
Date Drilled: 10/3/89
Drilled By: Test Well
Logged By: JCB
County: Delaware
Township or Munic. Chester
State: Pennsylvania
After Drilling

DEPTH (FT)	OVA (ppm)	OTHER TESTS	DESCRIPTION OF STRATUM
1	56	1,6,8,7 50%REC	Fill;Sand/Gravel/Silt Mix, Dry. Appears Clean.
3	290	6,8,4,6 30%REC	Fill;Gravel/Silt/Clay Mix, Damp. Appears Clean.
5	>1000	2,3,2,2 30%REC	Fill;Gravel/Sand Mix. Visual Petroleum Contamination.
7	>1000	2,2,2,1 5%REC	Fill;Gravel and Silt Matrix. Visual Petroleum Contamination.
9	>1000	2,1,3,5 40%REC	Fill;Gravel and Silt Matrix. Visual Petroleum Contamination.
11	>1000	1,3,1,1 90%REC	Fill;Num Rock Frags. w/ Matrix of Silt, V Dk Gr. Visual Petroleum Contamination.
13	>1000	1,0,0,0 90%REC	Fill;Num Rock Frags. w/ Matrix of Silt, V Dk Gr. Appears Clean.
15		8,11,7,4 1%REC	Gravel; Appears Clean. No SPT sample collected. Tried to drill and collect sample from auger flights without success.

NOTES:

APPENDIX 2
OVA REPORT FORMS

PROJECT: SCOTT PAPER COMPANY 0603

SITE LOCATION: Chester, Pennsylvania

WELL/BORING NUMBER:

DATE: 10/3/89

COMPLETED BY: JD

BACKGROUND: 4 ppm
TEMPERATURE: 75 °F

GC STANDARD	ELUTION TIME	COLUMN
* PCE	2:52	T-12
*		
*		

SAMPLE NUMBER	DEPTH INTERVAL	LITHOLOGY	OVA READINGS (ppm) BREATHING ZONE	OVA READINGS (ppm) BOREHOLE	OVA READINGS (ppm) HEADSPACE SAMPLE	COMMENTS ON GC ANALYSIS
B-1A	0-2				600	:06 120 ppm
B-1B	2-4				220	:12 22 ppm
B-1C	4-6				100	:12 12 ppm
B-1D	6-7				610	:12 225 ppm
B-1E	8-10				> 1000	:12 530 ppm
B-2A	0-2				> 1000	:08 300 ppm
B-2B	2-4				> 1000	:06 520 ppm
B-2C	4-6				100	:08 10 ppm
B-2D	6-8				480	:08 100 ppm
B-2E	8-10				> 1000	:06 540 ppm
B-2F	10-12				> 1000	:08 300 ppm

SITE LOCATION: Chester, Pennsylvania

WELL/BORING NUMBER:

BACKGROUND: 4 ppm
TEMPERATURE: 75 °F

DATE: 10/3/89

COMPLETED BY: JD

GC STANDARD	ELUTION TIME	COLUMN
• PCE	2:52	T-12
•		
•		

SAMPLE NUMBER	DEPTH INTERVAL	LITHOLOGY	OVA READINGS (ppm) BREATHING ZONE	OVA READINGS (ppm) BOREHOLE	OVA READINGS (ppm) HEADSPACE SAMPLE	COMMENTS ON GC ANALYSIS
B-2G	12-14				> 1000	:06 610 ppm
B-2H	14-16				> 1000	:06 680 ppm
B-3A	0-2				30 (Dial)	:08 2 ppm
B-3B	2-4				80	:08 22 ppm
B-3C	4-6				360	:08 80 ppm
B-3D	6-8				420	:08 140 ppm
B-3E	8-10				> 1000	:08 200 ppm
B-3F	10-12				> 1000	:08 360 ppm
B-3G	12-14				> 1000	:08 220 ppm
B-3H	14-16				940	:06 240 ppm

PROJECT: SCOTT PAPER COMPANY 0603 PAGE 3 OF 4

SITE LOCATION: Chester, Pennsylvania

WELL/BORING NUMBER:

BACKGROUND: 4 ppm
TEMPERATURE: 75 °F

DATE: 10/3/89

COMPLETED BY: JD

	GC STANDARD	ELUTION TIME	COLUMN
*	PCE	2:52	T-12
*			
*			

			OVA READINGS (ppm)			
SAMPLE NUMBER	DEPTH INTERVAL	LITHOLOGY	BREATHING ZONE	BOREHOLE	HEADSPACE SAMPLE	COMMENTS ON GC ANALYSIS
B-4A	4-6				0.6	None
B-4B	6-8				11	:06 2 ppm
B-4C	10-12				610	:06 180 ppm
B-5A	0-2				0.8	None
B-5B	2-4				200	:08 15 ppm
B-5C	4-4.3				260	:06 60 ppm
B-5D	6-8	Jar Not Tightly Sealed			6	None
B-5E	8-10				840	:06 240 ppm
B-5F	10-12				160	:06 30 ppm
B-5G	12-14				340	:06 90 ppm

PROJECT: SCOTT PAPER COMPANY 0603

SITE LOCATION: Chester, Pennsylvania

WELL/BORING NUMBER:

DATE: 10/3/89

COMPLETED BY: JD

BACKGROUND: 4 ppm
TEMPERATURE: 75 °F

GC STANDARD	ELUTION TIME	COLUMN
• PCE	2:52	T-12
•		
•		

SAMPLE NUMBER	DEPTH INTERVAL	LITHOLOGY	OVA READINGS (ppm) BREATHING ZONE	BOREHOLE	HEADSPACE SAMPLE	COMMENTS ON GC ANALYSIS	
B-6A	0-2				56	:06	12 ppm
B-6B	2-4				290	:08	70 ppm
B-6C	4-6				> 1000	:06	340 ppm
B-6D	6-8				> 1000	:06	230 ppm
B-6E	8-10				> 1000	:06	> 1000 ppm
B-6F	10-12				> 1000	:06	580 ppm
B-6G	12-14				> 1000	:08	> 1000 ppm